TRANSPORTATION SYSTEM

CONGESTION MANAGEMENT

SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS

2016–2040 RTP SCS

APPENDIX

ADOPTED | APRIL 2016

2016
2040
RTPSCS

APPENDIX

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CONGESTION MANAGEMENT

INTRODUCTION

Pursuant to federal metropolitan transportation planning and programming requirements, the development, establishment and implementation of a Congestion Management Process (CMP) is fully integrated into the regional planning process (23 CFR, S450.320).

The Federal Highway Administration (FHWA) defines the CMP as a "systematic approach that provides for effective management and operation, based on a cooperatively developed and implemented metropolitan–wide strategy, of new and existing transportation facilities eligible for funding under title 23 U.S.C., and title 49 U.S.C., through the use of operational management strategies."

In accordance with Federal law [23 U.S.C. S134 and 49 U.S.C. S5303–5305], SCAG has made the CMP an integral part of the regional transportation planning process, including SCAG's Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) and the Federal Transportation Improvement Program (FTIP).

FIGURE 1 Mobility Pyramid

The CMP is part of SCAG's integrated approach to improving and optimizing the transportation system, shown graphically as the Mobility Pyramid (**FIGURE 1**), to provide for the safe and effective management of the regional transportation system through the use of monitoring and maintenance, demand reduction, land–use, operational management strategies and strategic capacity enhancements.

The regional CMP elements described in this report are:

- The SCAG CMP and the 2016 RTP/SCS
- County Congestion Management Programs
- Performance Measures for the 2016 RTP/SCS
- Transportation Systems Management
- Transportation Demand Management
- Land Use Strategies
- New Infrastructure
- The Federal Transportation Improvement Program – Single Occupancy Vehicle (SOV) Capacity–Enhancing Projects

SCAG CMP AND THE 2016 RTP/SCS

The FHWA's CMP Guidebook outlines eight actions that are considered to be the core of the CMP. SCAG implements, monitors and evaluates these actions as part of its RTP/SCS process. These eight actions and how SCAG implements them are described below:

1. Develop Regional Objectives for Congestion Management – CMP objectives should be developed in coordination with the MPO's long-range plan, and should guide the decisions made throughout the CMP and the broader MPO planning process.

   As part of each RTP/SCS development process, SCAG performs a comprehensive objectives development process with hundreds of stakeholders across the region to identify regional objectives for a host of transportation planning areas, including congestion management. Adopted RTP/SCS goals address mobility, accessibility, reliability and productivity.

2. Define CMP Network – This step defines the geographic area to be covered by the CMP, as well as the CMP network and its transportation facilities that will be analyzed, including transit, bicycle, pedestrian and freight facilities.

As part of each RTP/SCS development process, SCAG defines the six–county geographic area to be covered by the RTP/SCS, and all transportation facilities that will be analyzed, including freeway, highway, arterial, transit, bicycle, pedestrian and freight facilities.

3. Develop Multimodal Performance Measures –The performance measures a MPO selects for use in the CMP should address the congestion management objectives identified above, addressing a wide variety of congestion-related issues.

   As part of each RTP/SCS development process, SCAG develops multimodal performance measures addressing a wide variety of congestion-related issues, including but not limited to mobility, accessibility, location efficiency, air quality and public health. Regarding congestion, SCAG evaluates person delay, truck delay and travel time.

4. Collect Data/Monitor System Performance – This step involves collecting and monitoring data to assess the CMP network's performance.

   As part of each RTP/SCS development process, SCAG updates and calibrates the regional travel demand model and activity-based model process using existing conditions, allowing it to provide an accurate representation of the performance of the existing highway and arterial system. Data sources include: Caltrans Highway Performance Monitoring System (PeMS) Caltrans Highway Performance Metering Program (HICOMP), Mobility Performance Report (MPR) and private sector data sources such as Inrix. In addition, SCAG collects a host of data on the performance of other modes of transportation, including transit, rail and goods movement.

5. Analyze Congestion Problems and Needs – This step identifies the congestion problems that are present in the region, and those that are anticipated based on the data collected for the RTP/SCS. This step also identifies sources of "unacceptable" congestion.

   As part of each RTP/SCS development process, SCAG performs an assessment of congestion levels in the base year (2012 for the 2016 RTP/SCS) as existing conditions and the baseline future "no build" conditions scenarios. SCAG then performs an alternatives analysis process utilizing model runs to tests various modal strategies and their ability to address the identified congestion issues. This process ultimately results in the selection of the preferred plan scenario.

6. Identify and Assess Strategies – This step involves developing strategies that are appropriate to mitigate the congestion identified in Steps 4 and 5. A wide variety of strategies should be considered, including transportation demand management, operational improvements and multimodal facilities and services.

   As part of each RTP/SCS development process, SCAG considers a comprehensive range of strategies, including transportation systems management, transportation demand management, and investments in multimodal capital and operational improvements.

7. Program and Implement Strategies – This step involves programming and implementing fiscally constrained projects through the RTP/SCS and Transportation Improvement Program (TIP) processes, to mitigate the identified congestion. CMP performance measures should be used as a tool for project prioritization.

   As part of each FTIP update and amendment development process, SCAG implements projects and strategies identified in the FTIP and RTP/SCS in collaboration with the county transportation commissions (CTCs).

8. Evaluate Strategy Effectiveness – This step involves the evaluation of how well the CMP strategies are working, whether further improvements are needed, and whether the strategies should be implemented elsewhere in the region.

   SCAG evaluates how its implemented strategies mitigate and reduce the identified congestion over time at the system level, using performance measures and monitoring.

COUNTY CONGESTION MANAGEMENT PROGRAMS

Under California law, urbanized areas must prepare a Congestion Management Program. These are comprised of several elements which are described in this section. In the SCAG region, the Los Angeles County Metropolitan Transportation Authority (Metro), Orange County Transportation Authority (OCTA), Riverside County Transportation Commission (RCTC), San Bernardino Associated Governments (SANBAG), and Ventura County Transportation Commission (VCTC) are the designated Congestion Management Agencies (CMAs) for their respective counties and are subject to the state requirements. While Imperial County is not participating in the state program, CMP-related activities there are accomplished through the development of the RTP/SCS and the FTIP by the Imperial County Transportation Commission (ICTC). SCAG has a state–mandated role in reviewing the county programs for inter-county compatibility and consistency, as well as for consistency with the adopted RTP/SCS. (Per CA Code Section 65088.3, a county may opt out of the state congestion management program.)

Because the magnitude of congestion and degree of urbanization differ among the counties in SCAG's region, each county program differs slightly in form and local procedure. The state program elements are described below.

ROADWAY PERFORMANCE – Each CMA monitors the performance of a county-designated freeway, highway and arterial system. This monitoring allows each county to track how their system and its individual components are performing against established standards, and how performance changes over time.

MULTI-MODAL PERFORMANCE – In addition to roadway performance, each county program contains an element to evaluate the performance of other transportation modes, especially transit.

TRANSPORTATION DEMAND MANAGEMENT (TDM) – Each county program contains a TDM component geared at reducing travel demand and promoting alternative transportation methods.

LAND USE PROGRAMS AND ANALYSIS – Each county program incorporates a program for analyzing the effects of local land use decisions on the regional transportation system.

CAPITAL IMPROVEMENT PROGRAM (CIP) – Using data and performance measures developed through the activities identified above, each county program develops a CIP. This becomes the first step in developing the County Transportation Improvement Program (TIP).

DEFICIENCY PLANS – The county programs contain provisions for "deficiency plans" to address unacceptable levels of congestion. Deficiency plans can be developed for specific problem areas or on a system-wide basis. Projects implemented through the deficiency plans must, by statute, have both mobility and air quality benefits. In many cases, the deficiency plans capture the benefits of transportation improvements that occur outside the county TIPs and FTIP such as non-traditional strategies and/or non-regionally significant projects.

The regional transportation planning process and the county congestion management process should be compatible with one another. To ensure consistency, SCAG and the CMAs have developed the Regional Consistency and Compatibility Criteria. Information on the county activities and resulting data is updated on a biennial basis by each CMA and supplied to SCAG and air quality management districts.

SCAG REGIONAL CMP NETWORK

Each CMA monitors the performance of its identified program network. This allows each county to track how its network and its individual components are performing against its established performance measures, and how the network's performance changes over time. At a minimum, all freeways and state highways are required to be monitored. The California Department of Transportation (Caltrans) monitors state highways and the Interstate system within the SCAG region. All the CMAs include major arterials in their networks as well. Once a roadway becomes part of the network, it cannot be removed.

The SCAG regional CMP Network consists of all the county networks combined. It includes all freeways, state highways and key arterials. In each county's program, the level of service is recorded for all roadways in the CMP network in accordance with California Government Code Section 65089. Imperial County also includes levels of service on major roadways in its Long Range Transportation Plan. Each county is required to update its program every two years.

SCAG CMP'S RELATION TO OTHER DOCUMENTS

Through the RTP/SCS, the SCAG CMP identifies strategies to reduce and mitigate congestion, which are incorporated into the FTIP. These FTIP projects are programmed through the CTCs, as all of these projects are incorporated in CTC long-range plans.

The SCAG CMP is also an important part of the South Coast Air Quality Management District's (AQMD) Air Quality Management Plan (AQMP). The FTIP and RTP/SCS contain congestion-mitigating projects that are transportation control measures (TCMs). These are incorporated into the AQMP to reduce air pollution emissions. These measures contribute toward attaining the National Ambient Air Quality Standards (NAAQS). Federal funds may not be programmed in the carbon monoxide and ozone non-attainment areas of Transportation Management Areas (TMAs) for any project resulting in significant increase in SOV capacity unless that project is addressed through the CMP. SCAG's FTIP process flags these SOV capacity-enhancing projects upon submittal by the CTCs, and it has a process to ensure that these projects meet the CMP requirements.

ROLES AND RESPONSIBILITIES OF PARTNER AGENCIES

Currently, five of the six counties in the SCAG region (all but Imperial County) have adopted programs that fall under the state congestion management requirements, and they are responsible for monitoring their respective networks and producing a report every two years. SCAG in turn has a state-mandated role in reviewing the county programs for inter-county compatibility and consistency, as well as for consistency with the adopted RTP/SCS. In the SCAG region, Los Angeles, Orange, Riverside, San Bernardino and Ventura counties are contained within the TMA. The CTCs also work with SCAG to program their projects incorporated in their long range plans in to the FTIP and RTP/SCS. Many of these projects are TCMs that are incorporated in to the AQMP, and the SCAQMD and SCAG work together to ensure the region improves its air quality. Finally, the FHWA monitors and reviews SCAG's processes to make sure CMP requirements are met.

Outside of state congestion management requirements, federal regulations require establishment of a traffic monitoring system (TMS). It is the responsibility of the state and Caltrans, working with the MPOs and local agencies, to develop a TMS. Caltrans, in accordance with applicable state law, is required to monitor the level of service (LOS) on the federal interstate and state highway systems. The LOS on arterials that is part of county networks or otherwise are provided by CMAs or local agencies. Immigration and Customs Enforcement monitors border crossings.

Caltrans, in conjunction with the California Highway Patrol (CHP), has created Transportation Management Centers (TMCs) to monitor daily traffic conditions and non-recurring congestion. With the help of electronic technologies such as electronic sensors in the pavement, freeway call boxes, video cameras, 911 calls, officers on patrol, Caltrans highway crews, ramp meter sensors, earthquake monitors, motorist cellular calls and commercial traffic reports, the TMC provides coordinated transportation management for normal commutes, special events and incidents affecting traffic. Much of the data is archived through Los Angeles County's Regional Integration of ITS Systems (RIITS), which should provide greater accuracy in the data collected and modeled. The TMCs are operated within each Caltrans district. For the SCAG region, Districts 7, 8, 11 and 12 all have TMCs.

PERFORMANCE MEASURES FOR THE 2016 RTP/SCS

SCAG uses a variety of multi-modal performance measures at both the regional and local level to measure congestion. They include roadway measures, transit measures and active transportation measures. The 2016 RTP/SCS is a performance-based plan, and SCAG has a comprehensive set of performance measures to evaluate how well the RTP/SCS addresses the goals and performance outcomes. Please see **TABLE 1** below and the Performance Measures appendix for more information.

TABLE 1 2016 RTP/SCS Performance Measures

Outcome	Performance Measure	Definition	Outcome Required	Supports RTP Goals	Data Source(s)
LOCATION EFFICIENCY	Share of growth in High Quality Transit Areas (HQTAs)	Share of the region's growth in households and employment in HQTAs		Improvement (increase) over No Project Baseline	RTP/SCS socio-economic small area data
	Land consumption	Greenfield land consumed and refill land consumed		Improvement over No Project Baseline	Scenario Planning Model
	Vehicle Miles Traveled (VMT) per capita	Average annual vehicle miles driven per person		Improvement (decrease) over No Project Baseline	Travel Demand Model
	Transit mode share	The share of total trips that use transit for work and non-work trips		Improvement (increase) over No Project Baseline	Travel Demand Model
	Average distance for work or non-work trips	The average distance traveled for work or non-work trips		Improvement (decrease) over No Project Baseline	Travel Demand Model
	Percent of trips less than 3 miles	The share of work and non-work trips which are fewer than 3 miles		Improvement (increase) over No Project Baseline	Travel Demand Model
	Work trip length distribution	The statistical distribution of work trip length in the region		Improvement (decrease) over No Project Baseline	Travel Demand Model
MOBILITY AND ACCESSIBILITY	Person delay per capita	Delay per capita can be used as a supplemental measure to account for population growth impacts on delay		Improvement (decrease) over No Project Baseline	Travel Demand Model
	Person delay by facility type (mixed flow, HOV, arterials)	Delay: Excess travel time resulting from the difference between a reference speed and actual speed		Improvement (decrease) over No Project Baseline	Travel Demand Model
	Truck delay by facility type (highways, arterials)	Delay: Excess travel time resulting from the difference between a reference speed and actual speed		Improvement (decrease) over No Project Baseline	Travel Demand Model
	Travel time distribution for transit, SOV, and HOV modes for work and non-work trips	Travel time distribution for transit, SOV, and HOV for work and non-work trips		Improvement (decrease in SOV share) over No Project Baseline	Travel Demand Model

TABLE 1 2016 RTP/SCS Performance Measures Continued

Outcome	Performance Measure	Definition	Outcome Required	Supports RTP Goals	Data Source(s)
SAFETY AND HEALTH	Collision rates by severity and by mode	Collision rate per 100 million vehicle miles by mode (all, bicycle/pedestrian); and number of fatalities and serious injuries by mode (all, bicycle/pedestrian)		Improvement (decrease) over No Project Baseline	CHP Accident Data Base, Travel Demand Model Mode Split Outputs
	Criteria pollutants emissions	CO, NO_x, $PM_{2.5}$, PM_{10}, and VOC	Meet Federal Transportation Conformity requirements		Travel Demand Model/ ARB EMFAC Model
	Air pollution-related health measures	Pollution-related respiratory disease incidence and cost		Improvement (decrease) over No Project Baseline	Scenario Planning Model
	Physical activity-related health measures	Physical activity/weight related health issues and costs		Improvement (decrease) over No Project Baseline	Scenario Planning Model
	Mode share of walking and biking	Mode share of walking and biking for work and non-work trips		Improvement (increase) over No Project Baseline	Travel Demand Model
ENVIRONMENTAL QUALITY	Criteria pollutant and greenhouse gas emissions	CO, NO_x, $PM_{2.5}$, PM_{10}, and VOC emissions; and per capita greenhouse gas emissions (CO2)	Meet Federal Transportation Conformity requirements and state SB 375 per capita GHG reduction targets		Travel Demand Model/ ARB EMFAC Model
ECONOMIC OPPORTUNITY	Additional jobs supported by improving competitiveness	Number of jobs added to the economy as a result of improved transportation conditions which make the region more competitive		Improvement (increase) over No Project Baseline	Regional Economic Model (REMI)
	Additional jobs supported by transportation investment	Total number of jobs supported in the economy as a result of transportation expenditures.		Improvement (increase) over No Project Baseline	Regional Economic Model (REMI)
	Net contribution to Gross Regional Product	Increase in Gross Regional Product due to transportation investments and increased competitiveness		Improvement (increase) over No Project Baseline	Regional Economic Model (REMI)
INVESTMENT EFFECTIVENESS	Benefit/Cost Ratio	Ratio of monetized user and societal benefits to the agency transportation costs		Greater than 1.0	California Benefit/Cost Model

TABLE 1 2016 RTP/SCS Performance Measures Continued

Outcome	Performance Measure	Definition	Outcome Required	Supports RTP Goals	Data Source(s)
TRANSPORTATION SYSTEM SUSTAINABILITY	Cost per capita to preserve multimodal transportation system to current and state of good repair condition	Annual cost per capita required to preserve the regional multimodal transportation system to current conditions		Improvement (decrease) over Base Year	Estimated using SHOPP Plan and recent California Transportation Commission 10-Year Needs Assessment
	State Highway System Pavement Condition	Share of distressed State Highway System lane miles		Improvement (decrease) over No Project Baseline	Pavement Management System (Caltrans)
	Local Roads Pavement Condition	Pavement Condition Index (PCI) for local roads		Improvement over No Project Baseline	Local Arterial Survey Database
ENVIRONMENTAL JUSTICE	See Table 3: Performance Measures: Environmental Justice		Meet Federal Environmental Justice requirements. No unaddressed disproportionately high and adverse effects for low income or minority communities		

Acronyms:
CHP: California Highway Patrol
EMFAC: Emissions Factors
SHOPP: State Highway Operation & Protection Program

ROADWAYS

Roadways include freeways, state highways and arterials. The five CMA counties in the SCAG region each have a state congestion management program–defined roadway network that is monitored for LOS approximately every two years. These include freeways, state highways and arterials, and their volume to capacity is measured for a LOS grade. The LOS is a required measure by California Government Code 65089. **TABLE 2** shows the LOS definitions.

SCAG uses additional performance measures to determine congestion levels of the roadway network in its travel demand model which include:

- Average Daily Speed
- Average Daily VMT
- Average Daily Delay
- Average Daily Heavy Duty Truck Delay
- Average Person Trip Length

TABLE 2 Level of Service (LOS) Definition

LOS	Flow Conditions	Operating Speed	Delay	Service Rating
A	Highest quality of service. Free traffic flow, low volumes/densities. Little or no restriction on speed or maneuverability	55+	None	Good
B	Stable traffic flow, speed becoming slightly restricted. Low restriction or maneuverability	50	None	Good
C	Stable traffic flow, but less freedom to select speed, change lanes or pass. Density increasing	45	Adequate	Adequate
D	Approaching unstable flow. Speeds tolerable but subject to sudden and considerable variation. Less maneuverability and driver comfort.	40	Adequate	Adequate
E	Unstable traffic flow with rapidly fluctuating speeds and flow rates. Short headways, low maneuverability and low driver comfort	35	Significant	Poor
F	Forced traffic flow. Speed and flow may drop to zero with high densities.	<20	Considerable	Poor

This appendix also identifies and reports on the top congested corridors in the SCAG region, including major bottleneck areas, congestion trends and non–recurring congestion at the regional and county level.

TRANSIT AND RAIL PERFORMANCE MEASURES

Each county also examines performance measures related to transit performance. OCTA uses four performance indicators which include vehicle headway, to measure how often service is available to transit patrons; load factor, measuring how many standees there are on a transit vehicle; on-time performance (OTP); and service accessibility, which measures the percentage of the population that has access to their service. Metro has a "mobility index", which is a composite index of passenger throughput times speed.

For the 2016 RTP/SCS, SCAG's six congestion performance analysis measures for transit and rail are:

- speed of service
- transit and rail modal share
- mileage of transit service by mode (e.g., local, express, BRT/BRT Lite and urban rail)
- bus lane mileage
- mileage of one-track operation for commuter rail
- accessibility to transit and rail

These performance measures will be measured by SCAG's travel demand model. Transit and rail accessibility are also reported on in the 2016 RTP/SCS (accessibility of population, households and employment to different types of transit [e.g., local bus, express bus, rapid bus, rail, etc.]).

ACTIVE TRANSPORTATION MEASURES

Active transportation includes biking and walking. For the 2016 RTP/SCS, SCAG's two congestion performance analysis measures for active transportation are:

- modal share
- mileage of bicycle facilities (e.g., Classes 1, 2 and 3)

Modal share is measured by SCAG's travel demand model, as well as mileage of bicycle facilities.

CAUSES OF CONGESTION

There are many causes of congestion, such as "too many cars," a poor jobs/housing balance, unsynchronized traffic lights, etc. In the SCAG region, the jobs/housing balance is particularly an issue given the geography and urban sprawl of our region. Many residents have traditionally continued to move farther and farther inland for cheaper housing, thereby adding to VMTs in our region. In addition, Southern California is just beginning to move away from its "car culture," so our region's rail and public transportation systems don't have the reach, ridership and modal share of eastern cities. Other causes of congestion include freeway and highway gaps, such as the I–710 and SR 2 gaps.

The FHWA defines four different types of congestion:[1]

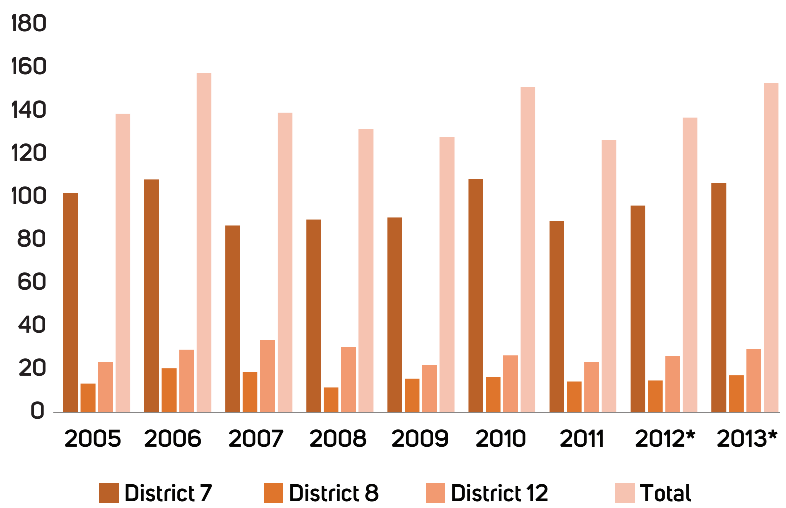
- **Intensity –** The relative severity of congestion that affects travel. Intensity has traditionally been measured through indicators such as V/C ratios or LOS measures that consistently relate the different levels of congestion experienced on roadways.
- **Duration –** The amount of time the congested conditions persist before returning to an uncongested state.
- **Extent –** The number of system users or components (e.g. vehicles, pedestrians, transit routes, lane miles) affected by congestion, for example the proportion of system network components (roads, bus lines, etc.) that exceed a defined performance measure target.
- **Variability –** The changes in congestion that occur on different days or at different times of day. When congestion is highly variable due to non-recurring conditions, such as a roadway with a high number of traffic accidents causing delays, this has an impact on the reliability of the system.

AGGREGATE REGIONAL AND COUNTY TRENDS

Caltrans publishes an annual traffic congestion report called the Mobility Performance Report (MPR). Data are presented here for the Caltrans Districts 7, 8 and 12 (covering Los Angeles-Ventura, Riverside-San Bernardino and Orange Counties, respectively) with respect to traffic congestion, in terms of vehicle hours of delay (VHD), and productivity, in terms of equivalent lost lane miles. The performance results are based on data collected by automated vehicle detector stations on the state highway system. Congestion is presented at two thresholds established by Caltrans based on engineering experience: severe congestion delay from vehicles traveling below 35 mph, and all congestion delay from vehicles traveling below 60 mph. Lost productivity represents the conversion of lost vehicle throughput, where speeds drop below 35 mph, into equivalent lost lane-miles. As described in the MPR, these lost lane-miles "represent a theoretical level of capacity that would be needed to achieve maximum throughput during the most congested time periods."

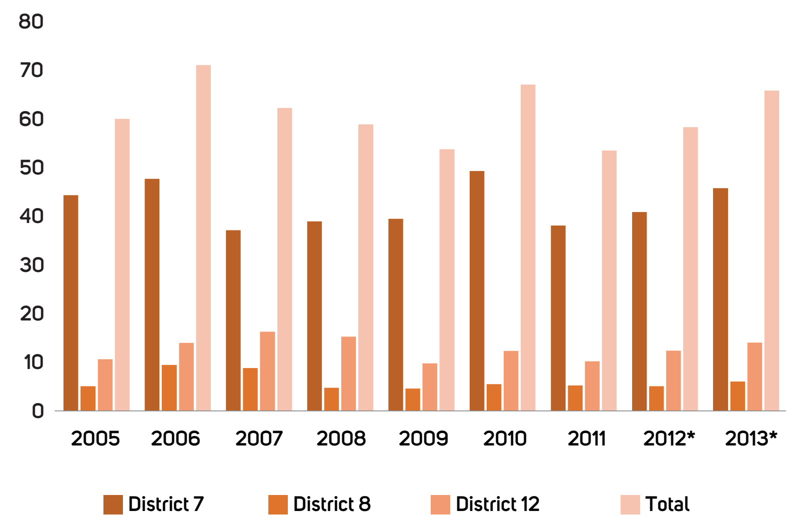
FIGURE 2 and **FIGURE 3** depict the vehicle hours of delay experienced in the SCAG region on an average weekday from 2005 to 2013. The charts show that congestion declined

FIGURE 2 Weekday Average Vehicle Hours of Delay at 60 mph (millions)



*Unofficial statistics
Source: Caltrans Mobility Performance Report

FIGURE 3 Weekday Average Vehicle Hours of Delay at 35 mph (millions)



*Unofficial statistics
Source: Caltrans Mobility Performance Report

TABLE 3 Weekday Average Vehicle Hours of Delay at 60 mph, by county (millions)

Year	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total
2009	87.5	21.8	10.2	5.3	2.7	127.5
2010	106.3	26.3	10.0	6.4	1.9	150.9
2011	86.5	23.2	8.3	5.9	2.2	126.2
2012*	93.0	26.1	8.5	6.1	2.7	136.6
2013*	103.3	29.2	9.4	7.8	2.9	152.6

**Unofficial statistics*
Source: Caltrans Mobility Performance Report

from 2006 to 2009, reflecting the Great Recession and a region-wide decline in travel. Preliminary figures for 2012 and 2013 (indicated by asterisks on bar charts) show that congestion has climbed back to near pre-recession levels. All counties in the SCAG region are showing increasing congestion since 2011. Imperial County, which is part of Caltrans District 11 with San Diego County, is not included in this report.

TABLE 3 and **TABLE 4** depict the vehicle hours of delay by county from 2009 to 2013.

Finally, the following charts depict the equivalent lost lane-miles data. **FIGURE 4** depicts lost lane-miles from 2009 to 2013. In 2013, preliminary estimates suggest that the SCAG region lost an equivalent of 800 lane-miles of highway capacity on an average weekday due to congestion. This is very significant as it compares to 11,017 total lane miles in the SCAG region, or 7.3% of the total regional highway network (excluding HOV lane miles).

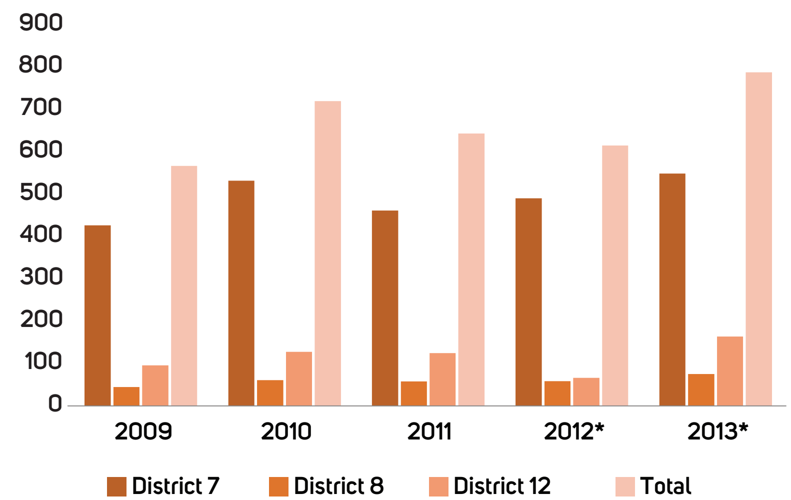
SCAG utilizes lost lane-miles to measure highway system productivity as part of the 2016 RTP/SCS performance measures analysis. **FIGURE 5** depicts highway system productivity for the AM and PM peak periods for both the 2012 Base Year and the 2040 Plan. The RTP/SCS investments are forecast to produce a 20 percent improvement in our region's highway productivity, over existing 2012 Base Year conditions.

TABLE 4 Weekday Average Vehicle Hours of Delay at 35 mph, by county (millions)

Year	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total
2009	48.8	12.3	3.6	1.9	0.5	67.0
2010	37.3	10.2	3.3	2.0	0.7	53.4
2011	39.9	12.4	3.4	1.7	1.0	58.2
2012*	44.7	14.0	3.8	2.2	1.0	65.7
2013*	103.3	29.2	9.4	7.8	2.9	152.6

**Unofficial statistics*
Source: Caltrans Mobility Performance Report

FIGURE 4 Weekday Average Lost Lane–Miles at 35 mph



**Unofficial statistics*
Source: Caltrans Performance Monitoring System (PeMS)

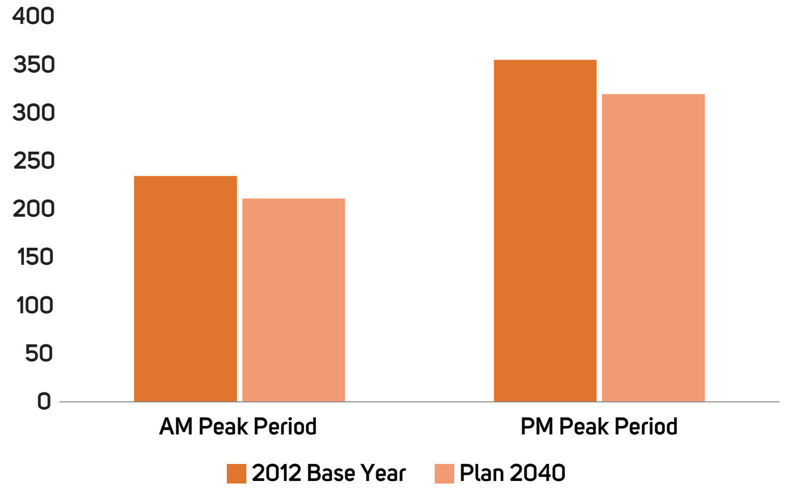
COUNTY CONGESTION MANAGEMENT PROGRAM TRENDS

Through the state Congestion Management Program, five of six counties in the SCAG region monitor a county-designated state Congestion Management Program network for LOS performance. In addition to freeways and state highways, which must be included in the network, the counties choose various arterials as part of the network. The CMP biennial monitoring allows each county to track how their system and its individual components are performing against established baseline and historical standards, and how this performance changes over time. State statute requires that the LOS on the county network perform at a grade of E or better, unless the baseline grade for that facility was not performing at that level.

OCTA is the latest CTC to have completed a state Congestion Management Program network analysis in November of 2015. Orange County's latest performance, using an average intersection capacity utilization (ICU) analysis rating, shows an improvement over their 1991 baseline. Between 1991 and 2015, the average AM peak-period ICU improved from 0.67 to 0.59, a 12.6 percent improvement, and the average PM peak–period ICU improved from 0.72 to 0.62, a 13.9 percent improvement.

RCTC also recently completed its last state program analysis in December of 2011. Like OCTA, RCTC's minimum LOS standard is E. Their 2011 analysis indicated that four freeway segments (three on I–15 and one on I–215) and three arterial segments were operating at LOS F levels. All seven of these locations however had programmed projects in RCTC's Capital Improvement Program (CIP) and are expected to improve the LOS to E or better.

FIGURE 5 RTP/SCS Improvements in Highway System Productivity (2012 Base Year versus 2040 Plan)



SANBAG is in the process of developing their 2015 state program. This includes a novel web-based tool to allow users to monitor congestion levels on their county network. LACMTA has been studying a congestion mitigation fee the last few years as part of their state program requirements. The potential fee links the transportation/land use nexus in order to fund transportation improvements in the future.

MAJOR BOTTLENECKS

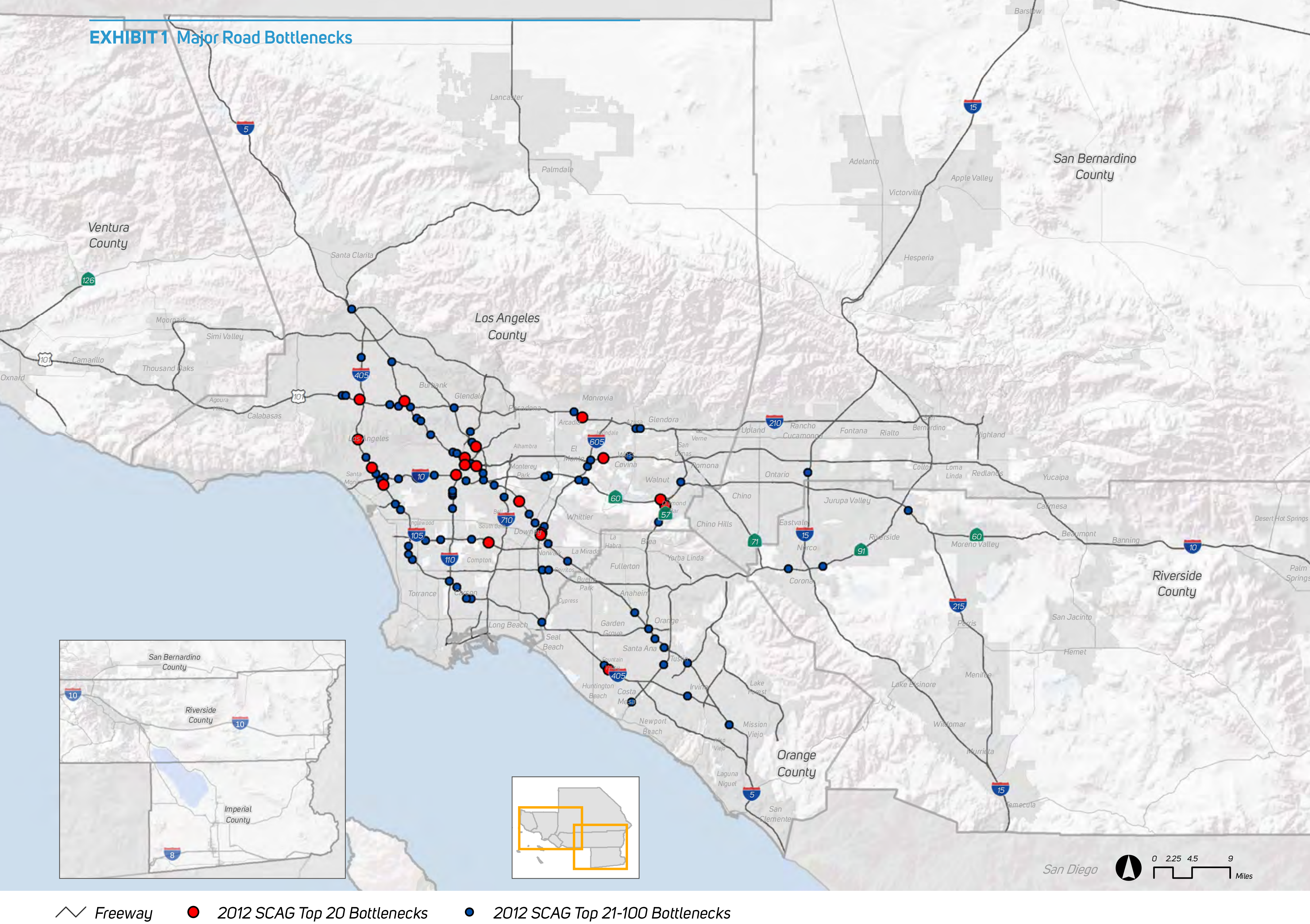
There are many major bottlenecks in the SCAG region that further increase congestion and delay. An analysis was done using PeMS data for 2012 to identify and rank the top 100 locations by annual hours of vehicle delay and are illustrated in **EXHIBIT 1** and **TABLE 5**. They are categorized as "very active," "somewhat active" or "not active." Most bottlenecks are active in the am or pm peak periods, or both, and some are active mid-day. The top ranked bottleneck in the SCAG region is on the San Diego Freeway. (I–405) at Getty Center Dr./Sepulveda Blvd. It results in over a million annual hours of vehicle delay. The second ranked is the junction of the Hollywood (U.S. 101) and Harbor freeways.(I–110), and the third-ranked is the Santa Ana Freeway. (I–5) at Washington Blvd. in the City of Commerce. They represent 900,000 and 700,000 hours of annual vehicle delay respectively. The large majority of the locations are in Los Angeles County, with 11 in Orange County, three in Riverside County and one in San Bernardino County. The location in San Bernardino County is at I–15 and Jurupa with 179,000 annual hours of delay. There are no bottlenecks in Imperial and Ventura Counties. The length of the bottleneck queues also varies, with severity and lane configuration as major factors.

NON–RECURRENT CONGESTION

Non-recurrent congestion is a major issue in our region. Non-recurrent congestion is caused by various forms of traffic incidents, and other variables such as construction projects and special events. In 2012, the estimated average percentage of congestion that was due to collisions or other incidents was about 47 percent. SCAG estimates lost capacity in the AM peak period, attributable largely to non–recurrent incidents such as collisions, weather conditions, stalled vehicles, etc., could have the effect of the loss of about 235 lane miles of freeway capacity when it is needed the most. The cost of physically adding this lost capacity by expanding existing roadways would exceed $500 million.

An analysis was done using PeMS data for the 4th Quarter of 2011 to examine the extent of recurrent versus non-recurrent congestion in the SCAG region. As shown in **FIGURE 6**, 53 percent of region-wide congestion was recurrent. This varies highly by county, however. For example, Riverside and San Bernardino Counties had recurrent congestion rates of only 41 percent and 26 percent respectively, and Ventura County weighed in at 25 percent.

EXHIBIT 1 Major Road Bottlenecks



(Source: Caltrans 2012 PeMS Data)

TABLE 5 Top 100 Bottlenecks

Rank	County	Route	Direction	Bottleneck Location	Absolute Postmiles		Latitude/ Longtitude	Total Annual Delay	Active During...		
					Bottleneck	Queue End			AM	Mid-Day	PM
1	LA	405	S	Getty Center Dr/N Sepulveda Ave	58.5	66.1	34.096057, -118.47685	1,048,100	●	○	
2	LA	101	S	SR-110	3.2	7.8	34.0673443333333, -118.256567111111	907,300	●	●	●
3	LA	5	S	E Washington Bl	127.9	134.0	33.993573, -118.1433845	705,200		○	●
4	LA	605	S	I-5	11.2	15.0	33.940382, -118.097178333333	619,200	○	○	●
5	LA	10	E	La Brea Ave	8.1	2.8	34.0340125, -118.3532715	599,700	○	○	●
6	LA	57	N	SR-57/Pathfinder	15.2	11.5	33.988721, -117.842841	568,000		○	●
7	LA	170	S	Magnolia Blvd/US-101/SR-134	2.3	6.1	34.163266, -118.382094	556,300	●	○	
8	LA	101	S	Garey St	1.8	5.4	34.053512, -118.232514	543,300		○	●
9	LA	605	N	I-5	11.4	9.0	33.936927, -118.098751	512,600	●	○	●
10	LA	10	W	Francisquito Ave/Vineland Ave	31.3	34.9	34.069011, -117.971555	484,300	●	○	○
11	LA	105	E	Long Beach Blvd	11.9	8.0	33.9226491666667, -118.205176166667	476,300	○	○	●
12	LA	210	E	Huntington Ave	33.4	28.8	34.1388025, -118.01522775	468,500		○	●
13	LA	405	N	Santa Monica Blvd	54.7	51.9	34.047963, -118.44737	427,500	○	○	●
14	LA	10	E	I-110	12.7	9.9	34.038052, -118.274457	424,800	●	○	●
15	ORA	405	N	Brookhurst	13.7	10.6	33.70672075, -117.95581375	411,200		○	●

Legend: ● Very Active ○ Somewhat Active Not Active

TABLE 5 Top 100 Bottlenecks Continued

Rank	County	Route	Direction	Bottleneck Location	Absolute Postmiles		Latitude/ Longtitude	Total Annual Delay	Active During...		
					Bottleneck	Queue End			AM	Mid-Day	PM
16	LA	5	N	SR-110/Riverside Dr	137.7	133.4	34.086881, -118.233611	400,400	○	○	●
17	LA	405	N	National Blvd	52.3	48.6	34.019085, -118.423757	397,300	●	○	
18	LA	110	S	Third St	23.0	27.1	34.055433, -118.256754	396,800	●	○	○
19	LA	101	N	Haskell Ave	19.0	16.9	34.165132, -118.474715	377,200		○	●
20	LA	60	E	SR-57/Brea Canyon/Lemon	23.5	18.4	33.999118625, -117.852625875	367,100		○	●
21	LA	405	S	Howard Hughes Pkwy	48.7	53.2	33.976541, -118.387273	357,300			●
22	LA	101	N	Lankershim Blvd/Universal Studios	11.2	9.1	34.1346145, -118.356871	355,400			●
23	LA	60	E	San Gabriel Blvd/Paramount Blvd	8.4	3.9	34.03835525, -118.083823583333	338,900		○	●
24	LA	60	W	Soto St	0.6	3.2	34.029636, -118.217534	326,900	●	○	○
25	LA	101	S	Laurel Canyon	14.1	15.9	34.154314, -118.394541	313,400	○	○	●
26	LA	5	N	Pioneer Blvd	121.9	118.8	33.921738, -118.082976333333	306,900	○	●	●
27	LA	170	N	Arleta	7.4	5.7	34.230591, -118.409589	306,000		○	●
28	ORA	5	N	E 17th St	104.6	102.2	33.76017875, -117.86166025	305,400		○	●
29	LA	10	W	Westwood	4.0	7.6	34.031903, -118.4213	300,700	●	●	○
30	ORA	55	S	Victoria	2.8	5.7	33.651901, -117.908673	300,300		●	●

Legend: ● Very Active ○ Somewhat Active Not Active

TABLE 5 Top 100 Bottlenecks Continued

Rank	County	Route	Direction	Bottleneck Location	Absolute Postmiles		Latitude/ Longtitude	Total Annual Delay	Active During...		
					Bottleneck	Queue End			AM	Mid-Day	PM
31	LA	210	E	Azusa/Pasadena	40.2	37.5	34.1207266666667, -117.904954333333	298,800	○	○	●
32	LA	110	N	Washington Blvd	21.3	14.1	34.037093, -118.274088	297,700	●	○	●
33	LA	405	N	Inglewood Ave	42.2	37.5	33.89154575, -118.36196925	280,800	●	○	
34	LA	405	N	Montana	56.2	50.9	34.065808, -118.460396	273,100		○	●
35	LA	101	S	Coldwater Canyon	15.1	17.6	34.156627, -118.412272	270,000	●	●	○
36	LA	57	S	Sunset Crossing	16.9	18.6	34.029739, -117.811086	269,600	●	○	●
37	LA	405	N	Nordhoff	68.6	65.8	34.237367, -118.472933	269,500		○	●
38	LA	405	S	Wilmington	33.2	41.0	33.825757, -118.24005	268,600			●
39	LA	101	S	Louise	21.1	24.0	34.171083, -118.510919	262,300	●	●	
40	LA	5	S	Alondra Ave	118.6	122.4	33.8915495, -118.0428305	259,000		○	●
41	LA	134	W	Vineland	0.4	2.3	34.153052, -118.36974	257,500	○	○	●
42	LA	134	E	I-5	5.7	3.0	34.15272175, -118.2801205	248,600		○	●
43	LA	405	S	I-605	24.1	27.7	33.786942, -118.094686	248,000			●
44	LA	5	N	Guatemala	126.1	119.9	33.971763, -118.122905	243,600	●	○	
45	LA	101	S	Barham Dr	10.7	15.1	34.129747, -118.348132	242,800	●	○	○

Legend: ● Very Active ○ Somewhat Active Not Active

TABLE 5 Top 100 Bottlenecks Continued

Rank	County	ROUTE	Direction	Bottleneck Location	Absolute Postmiles		Latitude/ Longtitude	Total Annual Delay	Active During...		
					Bottleneck	Queue End			AM	Mid–Day	PM
46	LA	101	S	Balboa Ave	20.8	22.0	34.171202, –118.503926	239,500	●	○	●
47	LA	60	E	San Gabriel Blvd/Paramount Blvd	7.9	4.3	34.03634725, –118.09134175	237,400		○	●
48	LA	110	S	I–405	8.6	12.1	33.855273, –118.2849	232,800	○	○	●
49	LA	10	W	Arlington	10.1	11.3	34.036614, –118.31917	230,800	●	○	○
50	LA	110	S	Vernon	18.8	21.3	34.002226, –118.28122	229,700	○	○	●
51	LA	405	N	Pico / Olympic	53.9	51.7	34.038204, –118.439159	226,100	●	●	○
52	LA	405	N	National Blvd	52.9	47.5	34.026728, –118.429807	224,700	●	○	
53	LA	10	E	San Pedro St	14.1	10.5	34.028118, –118.253469	217,600		○	●
54	LA	91	E	Studebaker	11.4	8.5	33.876279, –118.095037	215,000	○	○	●
55	LA	405	S	Lucerne St	33.8	35.6	33.826193, –118.24972	214,400		○	●
56	LA	5	N	Calzona	131.8	130.0	34.021135, –118.195375	213,900	●	○	
57	LA	110	S	Gage	17.3	19.8	33.980182, –118.281036	212,600	○		●
58	LA	10	W	Robertson	5.7	9.4	34.029948, –118.392928	212,200	●	○	○
59	LA	210	W	Citrus	40.5	43.6	34.121161, –117.896071	207,700	●		
60	LA	405	N	Rosecrans Ave	42.9	36.9	33.900921, –118.370315	206,000	●	○	

Legend: ● Very Active ○ Somewhat Active Not Active

TABLE 5 Top 100 Bottlenecks Continued

Rank	County	Route	Direction	Bottleneck Location	Absolute Postmiles		Latitude/ Longtitude	Total Annual Delay	Active During...		
					Bottleneck	Queue End			AM	Mid–Day	PM
61	ORA	405	S	Jeffrey Rd	3.6	6.5	33.6630485, –117.793856	205,800	○		●
62	LA	2	W	San Fernando Rd	8.5	10.6	34.112548, –118.245533	204,600	●		
63	ORA	5	S	El Toro	90.9	93.8	33.614654, –117.707825	203,700			●
64	LA	60	W	Crossroads	13.0	17.0	34.029247, –118.008439	201,400	●	○	○
65	LA	605	N	I–10	21.6	19.7	34.054653, –118.00395	197,100		○	●
66	RIV	91	E	Lincoln Ave Off/Maple St On	42.9	38.7	33.881507, –117.588822916667	196,100		○	●
67	LA	101	S	Silver Lake	5.1	7.4	34.076926, –118.280908	195,400	○	●	●
68	LA	91	W	Pioneer Blvd	11.9	14.4	33.8765586666667, –118.081886333333	191,500	●	○	●
69	LA	10	E	I–605	29.8	26.6	34.065326, –117.997535	189,700		○	●
70	LA	405	S	Jefferson	49.6	53.1	33.986242, –118.398076	189,300		○	●
71	LA	57	S	Brea Canyon	13.2	17.2	33.960374, –117.856055	188,800	●		
72	SBD	15	S	Jurupa	107.7	109.6	34.047527, –117.550244	179,000	○	○	●
73	LA	5	N	Dorris	138.1	132.7	34.090311, –118.238626	179,000	○	○	●
74	LA	210	W	Santa Anita Ave	32.0	34.5	34.1481325, –118.032958	178,800	●	○	○
75	LA	105	W	Normandie	6.0	7.9	33.926754, –118.304542	177,200	●	○	

Legend: ● Very Active ○ Somewhat Active Not Active

TABLE 5 Top 100 Bottlenecks Continued

Rank	County	Route	Direction	Bottleneck Location	Absolute Postmiles		Latitude/ Longtitude	Total Annual Delay	Active During...		
					Bottleneck	Queue End			AM	Mid-Day	PM
76	LA	5	N	Stadium Way	138.4	131.9	34.094038, -118.242314	177,100			●
77	LA	105	E	Wilmington	9.7	7.1	33.928223, -118.240518	177,100	○	○	●
78	ORA	57	S	SR-22/I-5	0.2	2.9	33.777415, -117.874735	173,600	●		○
79	LA	101	N	Argyle	8.6	6.0	34.105922, -118.327165	172,300			●
80	ORA	405	S	Warner Ave	14.3	17.6	33.714376, -117.96538225	172,200	●	○	
81	ORA	5	N	Anaheim Way/Katella Av	108.7	106.1	33.8051606666667, -117.903963	171,100			●
82	LA	101	S	Rampart	4.6	7.4	34.074797, -118.273463	169,200	●	●	●
83	LA	10	E	Vincent Blvd	34.4	31.7	34.072202, -117.917964	168,800			●
84	LA	5	S	Fourth	134.0	135.7	34.041407, -118.218373	168,800	●	○	
85	LA	60	W	Workman Mill Rd	12.2	17.1	34.03138, -118.02126	166,900	●	●	○
86	LA	101	N	Broadway	2.4	0.5	34.056973, -118.242279	165,800	○	●	●
87	LA	5	S	Lakewood Bl	124.8	128.9	33.956897, -118.110532	165,500		○	●
88	LA	605	S	Telegraph	12.4	14.7	33.950974, -118.091381	160,300	●	○	●
89	LA	110	N	Vernon	19.1	15.4	34.006152, -118.280854	155,500	●	○	○
90	RIV	215	S	Blaine St	34.1	35.3	33.982732, -117.342665	154,400		○	●

Legend: ● Very Active ○ Somewhat Active Not Active

TABLE 5 Top 100 Bottlenecks Continued

Rank	County	Route	Direction	Bottleneck Location	Absolute Postmiles		Latitude/ Longtitude	Total Annual Delay	Active During...		
					Bottleneck	Queue End			AM	Mid–Day	PM
91	LA	405	S	Truck Scale	35.6	37.8	33.845636, –118.269942	154,200		○	●
92	LA	105	E	Yukon	4.2	2.4	33.924911, –118.335537	153,700		○	●
93	LA	405	S	I–105	43.9	45.4	33.914766, –118.370486	152,500		○	●
94	RIV	91	E	Mckinley Ave	46.6	44.5	33.8863645, –117.51748625	152,000		○	●
95	ORA	5	N	Jamboree Rd	99.8	97.7	33.719344, –117.7944745	151,400	○	○	●
96	ORA	55	N	Warner Ave	8.6	6.2	33.716619, –117.843611	142,300		●	●
97	LA	110	N	King	19.4	14.9	34.010617, –118.280787	141,600	●	○	
98	LA	710	N	Washington Blvd	17.2	15.1	34.0005296666667, –118.174889833333	140,900	●	○	○
99	LA	5	N	I–210	160.7	159.1	34.320108, –118.4945	140,900		○	●
100	ORA	5	S	1st St	103.1	104.4	33.745553, –117.842538	140,500	●	○	○

Legend: ● Very Active ○ Somewhat Active Not Active

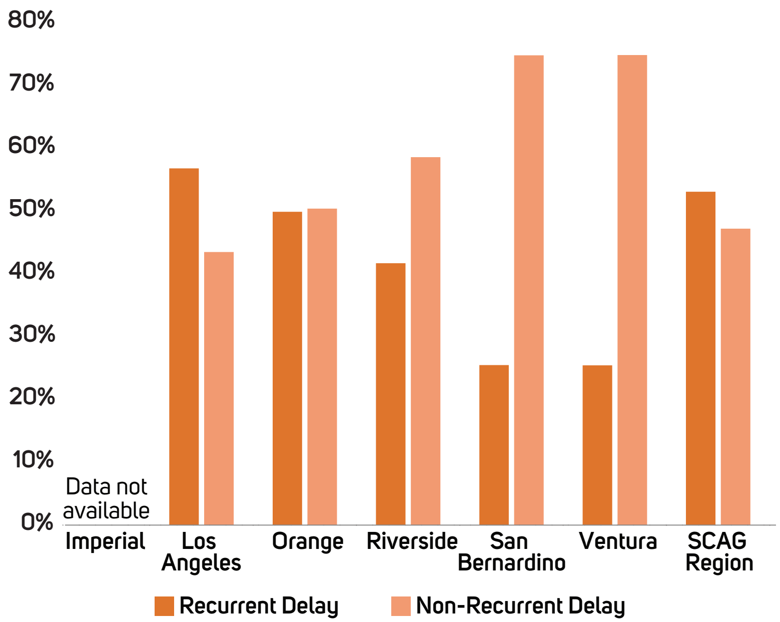
This suggests that less built-out and developed areas experience more non-recurrent congestion because there is much less constant and general predictable congestion. Orange County has nearly equal levels of recurrent and non-recurrent congestion, and Los Angeles County is the only county in the SCAG region that has more recurrent congestion, at 58 percent of the time. Imperial County is part of Caltrans District 11 along with San Diego County, and was not included in the analysis. (Note: The actual percentage is likely exaggerated, due to the manner in which PeMS handles some data; more research is needed to verify this assessment.)

CMP TOOLBOX AND STRATEGIES

TRANSPORTATION SYSTEMS MANAGEMENT

Transportation Systems Management (TSM) employs a series of techniques designed to maximize the capacity and efficiency of the existing transportation system and its facilities by increasing its supply via Intelligent Transportation Systems (ITS) and Transportation Demand Management (TDM), and also to reduce the dependence on SOV travel. The common goals of TSM are to reduce traffic congestion, improve air quality and reduce or eliminate the need to construct new and expensive transportation infrastructure.

FIGURE 6 Recurrent vs. Non–Recurrent Congestion (2011 4th Qtr.)



CORRIDOR SYSTEM MANAGEMENT PLANS

In 2006, California initiated the Corridor Mobility Improvement Account (CMIA) to improve the state highway system. CMIA program guidelines require the development of Corridor System Management Plans (CSMPs) for those projects receiving CMIA funding, to ensure that mobility improvements are maintained over time.

CSMPs provide a framework for long-term corridor management, with a focus on operational improvements. The intention of the CSMP effort is to continually monitor system performance and identify system improvements that are lower-cost, relatively quick to implement, and less capital-intensive than major corridor widening and expansion projects.

In the SCAG region, CSMPs were developed by Caltrans for I–5 (two segments) and I–405 in Los Angeles County; I-5, SR-55, SR–57, SR–91, and SR–22/I–405/I–605 in Orange County; SR–91 and I–215 in Riverside County; I–10 and I–215 in San Bernardino County; and US–101 in Ventura County . SCAG contributed funding toward the I–405 CSMP in Los Angeles County, as well as toward the I–210 CSMP undertaken as part of the Governor's Go California initiative.

The CSMP development efforts began with a comprehensive assessment of corridor performance and the identification of congestion points called bottlenecks. This information was shared and verified with the stakeholders along the corridors. To address the bottlenecks, operational and minor capacity improvement projects were developed with input from stakeholders. These proposed improvements were analyzed using microsimulation models that were created specifically for the corridors. The potential improvements include ITS technologies, ramp metering, auxiliary lanes, ramp and interchange improvements and incident management.

Including improvements proposed in the CSMPs, the 2016 RTP/SCS earmarks $9.2 billion for TSM improvements, such as extensive advanced ramp metering, enhanced incident management, bottleneck removal to improve flow (e.g. auxiliary lanes), expanding the integration of our traffic signal synchronization network, and data collection to monitor system performance.

SYSTEM MANAGEMENT INITIATIVES

Caltrans, SCAG and county partners have worked together to improve the efficiency of our highways and arterials. Initiatives related to maximizing the productivity of our roadways include:

- In Orange County, Caltrans completed the Corridor System Management Plans (CSMPs), which identify operational strategies to improve the productivity on highway corridors. CSMPs were completed for State Routes 22, 55, 57, 91 and Interstates 5, 405 and 605 in Orange County.
- In Los Angeles, Caltrans, in coordination with Los Angeles Metro and various cities, have embarked on the first Integrated Corridor Management project on Interstate 210. This project aims to minimize congestion due to collisions and is referred to as the Connected Corridors initiative. Over the next 10 years, Caltrans plans to implement similar projects on 25 additional congested corridors statewide.
- Arterial Signal Synchronization projects have been completed on various arterials through the region to optimize traffic flow.
- In Los Angeles, Caltrans also began working on another corridor management initiative on Interstate 110 to coordinate highway ramp metering with arterial signals. This project is referred to as the Dynamic Corridor Congestion Management (DCCM) initiative.
- Various efforts have been completed to inform the traveling public of expected travel times to various destinations, and in some cases provide travel time comparisons with transit.

INTELLIGENT TRANSPORTATION SYSTEMS

Intelligent Transportation Systems (ITS) make use of advanced detection, communications and computing technology to improve the safety and efficiency of our surface transportation network. ITS is a program of technology applications and integration that allows system operators and users to better manage and optimize the use of transportation system capacity. ITS allows for the use of information technologies to collect data about the status of our highways, traffic signals, transit vehicles, freight vehicles, passenger trains and shared-ride vehicles and integrates that data in ways that affect and improve the efficiency of the system.

ITS systems are not new to the SCAG region. Systems like the City of Los Angeles Automated Traffic Surveillance and Control (ATSAC) computer–based signal system have been in place since first installed around the L.A. Coliseum for the 1984 Olympics. ATSAC assists in optimizing signal timing to accommodate varying traffic demands throughout the day. Metro implemented its first Metro Rapid lines in 2000 that use Transit Signal Priority (TSP) provided by the ATSAC system. These technologies have advanced to provide Automatic Vehicle Location (AVL) services for dispatching and operations management of public transit buses, taxicabs, Uber, Lyft and many other transportation systems. They also now provide very accurate traffic speed and incident information for travel time and routing options, and provide transit and shared-ride users accurate, real-time arrival and departure information. In addition, the four Caltrans Districts (7, 8, 11 and 12) and most medium to large sized jurisdictions have Traffic Management Centers (TMCs) for their traffic signaling systems, and to manage natural and manmade disasters if that need were to arise.

ARTERIAL, HIGHWAY AND FREEWAY ITS STRATEGIES

SYSTEM MANAGEMENT – System Management is a multi-pronged approach to addressing congestion that includes adding new capacity, maintaining its infrastructure, investing in and encouraging the use of alternate modes such as transit and rail, and Transportation Management Systems (TMS) and strategies. System management aims to restore lost capacity by adopting operational improvement investments that adjust highway infrastructure to reduce bottlenecks.

TRANSPORTATION MANAGEMENT SYSTEMS (TMS) – TMS strategies essential for improved operations include traffic control, traveler information and incident management.

- Ramp metering is a traffic control signal strategy for managing traffic flow on freeways by regulating the traffic entering the freeway or moving from one freeway to another through the use of control devices on entrance ramps or freeway connectors.
- Adaptive ramp metering is a traffic response type of ramp metering that seeks to optimize a multiple-ramp section of a highway, often with the control of flow through a bottleneck as the ultimate goal. In a coordinated metering plan, the metering rates of a ramp are determined based on the prevailing traffic conditions of an extended section of roadway.
- Advanced Traffic Management systems are operational improvement strategies with business processes that rely heavily on technology to manage growing congestion. These processes include traffic control, traveler information and incident management.
- Variable Speed Limits are speed limits that change using electronic signs based on road, traffic and weather conditions intended to reduce secondary collisions

INTEGRATED CORRIDOR MANAGEMENT (ICM) – ICM is the integration and operational coordination of multiple transportation networks and cross-network connections comprising a corridor and the institutional coordination of those agencies and entities responsible for corridor mobility. It enables agencies to see the overall impact of multimodal transportation network management decisions and to optimize the movement of people and goods within the corridor instead of just on individual networks.

ACTIVE TRAFFIC MANAGEMENT (ATM) is a congestion management approach that dynamically manages recurrent and non-recurrent congestion based on prevailing traffic conditions. This congestion management approach consists of a combination of operational strategies that, when implemented in concert, fully optimize the existing infrastructure and provide measureable benefits to the transportation network and the motoring public. These strategies include speed harmonization, temporary shoulder use, junction control and dynamic signing and rerouting.

ARTERIAL MANAGEMENT SYSTEMS – Arterial Management Systems manage traffic along arterial roadways, employing traffic detectors, traffic signals and various means of communicating information to travelers. These systems make use of information collected by traffic surveillance devices to smooth the flow of traffic along travel corridors.

- Advanced Signal Actuation strategies include coordinated signal operations across neighboring jurisdictions with freeway ramp meters, as well as centralized control of traffic signals.
- Coordinated Signal Timing/Signal Synchronization is a traffic signal operations strategy that promotes the smooth flow of traffic along an arterial to minimize stops, avoid congestion and minimize fuel consumption and air quality impacts resulting from the acceleration and idling of vehicles. This is done by calculating the arrival time for a group of vehicles at each intersection traveling at a specified speed, and then the traffic signals are strategically timed to turn green just as the group of vehicles arrives at each intersection. In order for the traffic signals to be synchronized, a group of signals must all be set to run on the same cycle length.
- Traffic Signal Priority/Preemption (TSP) TSP is a strategy of giving special signal timing treatment to transit vehicles or emergency vehicles at signalized intersections. Normal operation of traffic lights is preempted green to allow emergency vehicles to help reduce response times and enhance safety. Signal preemption for transit systems allows public transportation priority access through intersections or at crossings to prevent collisions and increase passenger throughput.
- Automated Traffic Surveillance and Control (ATSAC) System is the centralized adaptive traffic signal control system for the City of Los Angeles. The system provides real-time monitoring and adjustment of signal timing for nearly 4,400 signalized intersections citywide.

INCIDENT MANAGEMENT SYSTEMS – Incident Management Systems are a combination of policies and strategies that effectively coordinate the available resources to reduce incident durations. Incident management strategies include enhanced incident management systems that entail upgrading or enhancing the current incident management system to include deployment of ITS field devices, central control/communications software, communications medium (e.g., fiber optics), advanced traveler information systems, and/or freeway service patrols to reduce incident detection, verification response, and clearance times.

TRAVELER INFORMATION SYSTEMS – Traveler Information Systems provide travelers with information in two categories, pre–trip and en–route, using existing and evolving technologies such as changeable message signs, weather detection/warning, information kiosks, highway advisory radio, etc. Advanced Traveler Information Systems (ATIS) include traveler information dispensed through 511 and other mobile systems that empower travelers to manage their trips in the most efficient manner.

RAIL ITS STRATEGIES

POSITIVE TRAIN CONTROL (PTC) – PTC is a set of highly advanced technologies designed to automatically stop a train before certain types of accidents occur. Specifically, PTC, as mandated by Congress in the Rail Safety Improvement Act of 2008 (RSIA, P.L. 110-432, 2000), must prevent train-to-train collisions, derailments caused by excessive speed, unauthorized incursions by trains onto sections of track where maintenance activities are taking place, and movement of a train through a track switch left in the wrong position. PTC will not prevent accidents caused as a result of track or equipment failure, improper vehicular movement through a grade crossing, trespassing on railroad tracks, and some types of train operator error.

PTC is a sophisticated, predictive system that works to prevent accidents. The technology must account for a number of factors to measure the appropriate train stopping distance, including train information (weight, length); track composition (curvature, terrain); train speed; and train authority (authorization to move across a stretch of track). There are three main elements of a PTC system, which are integrated by a wireless communications system:

- **Onboard or Locomotive System –** This system monitors the train's position and speed and activates braking as necessary to enforce speed restrictions and unauthorized train movement into new sections of track.
- **Wayside System –** The wayside system monitors railroad track signals, switches and track circuits to communicate authorization for movement to the locomotive.
- **Back Office Server (BOS) –** The BOS is the storehouse for all information related to the rail network and trains operating across it — speed limits, track composition, speed of individual locomotives, train composition, etc. — and transmits the authorization for individual trains to move into new segments of track.[2]

TRANSIT ITS STRATEGIES

AUTOMATIC VEHICLE LOCATION (AVL) – AVL systems detect bus locations, direction, speed and arrival and departure information. AVL systems enable:

- the monitoring of bus performance to increase operational efficiency;
- improved safety and security; and
- enhanced customer information such as real-time arrival and departure information and trip planning that increase ridership and customer satisfaction.

AVL systems are often used in conjunction with TSP systems to improve running times and reduce delays to reduce operational costs and inefficiencies, and are a primary component of BRT and BRT Light systems.

TRANSIT SIGNAL PRIORITY (TSP) – TSP gives transit vehicles signal priority to improve passenger throughput and bus speed. These are either hard-wired loop detection systems or wireless systems. Most commonly, the green phase is extended to allow a transit vehicle through the intersection.

ADVANCED PASSENGER COUNTING SYSTEMS (APCS) – These systems automatically count boarding and alighting passengers. The boardings are acquired through the fare payment transactions or with APCs, while the alightings must be acquired through APCs. APCs allow for a total population of boardings and alightings to be recorded by a transit operator, resulting in optimal route scheduling and planning.

SMART CARDS/ELECTRONIC FARE SYSTEMS – Smart card systems speed boarding, reduce stop dwell time, and reduce fraud and fare evasion. They also improve in origin/destination information for optimal planning and scheduling. Smart cards may also have a cash purse that can be used for non-transit, retail transactions.

TRAVELER INFORMATION SYSTEMS – Traveler Information Systems include trip planning software, and real-time arrival and departure information for the transit customer.

AUTOMATED AND CONNECTED VEHICLES

Automated and connected vehicle (ACV) technologies involve less driver input and in the future completely driverless vehicles that will have the potential to reduce congestion through better optimization of transportation facility supply by enabling more vehicles to use existing infrastructure and also improve safety. Some automated and connected vehicle technologies are already available, but these are only a fraction of what will be available in the future. ACV technology includes the ability to rely on digital maps and on-board sensing to operate without any driver input, and connected vehicle operation is where vehicles communicate with each other and roadway infrastructure such as traffic signals and roadway sensors.

Connected vehicles are vehicles that use communication technologies to communicate with the driver, other vehicles (vehicle-to-vehicle [V2V]), roadside infrastructure (vehicle-to-infrastructure [V2I]), and the Cloud. ACVs improve vehicle efficiency, commute times and safety. The U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) has defined vehicle automation into five levels:

- **No-Automation (Level 0) –** The driver is in complete and sole control of the primary vehicle controls – brake, steering, throttle and motive power – at all times.
- **Function–Specific Automation (Level 1) –** Automation at this level involves one or more specific control functions. Examples include electronic stability control or pre-charged brakes, where the vehicle automatically assists with braking to enable the driver to regain control of the vehicle or stop faster than possible by acting alone.
- **Combined Function Automation (Level 2) –** This level involves automation of at least two primary control functions designed to work in unison to relieve the driver of control of those functions. An example of combined functions enabling a Level 2 system is adaptive cruise control in combination with lane centering.
- **Limited Self-Driving Automation (Level 3) –** Vehicles at this level of automation enable the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions and in those conditions to rely heavily on the vehicle to monitor for changes in those conditions requiring transition back to driver control. The driver is expected to be available for occasional control, but with sufficiently comfortable transition time. The second-generation Google car is an example of limited self-driving automation.
- **Full Self–Driving Automation (Level 4) –** The vehicle is designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip. Such a design anticipates that the driver will provide destination or navigation input, but is not expected to be available for control at any time during the trip. This includes both occupied and unoccupied vehicles. The third-generation Google car is an example of full self-driving automation. Vehicles with level 4 automation may also be referred to autonomous vehicles.

Only Level 2 is currently in operation, however, the federal government and manufacturers are now developing, and testing Level 4 automation technologies on public roads in certain states that have passed enabling legislation which includes California.[3]

TRANSPORTATION SYSTEM

ROADWAYS

The Southern California freeway system has an extensive ITS system that covers most of the urbanized portion of our region. Loop detectors in the pavement and video cameras provide information on speed and volume, and identify congestion and incidents which are fed to Caltrans/California Highway Patrol (CHP) TMCs. The TMCs are manned 24/7 by CHP and Caltrans personnel, and monitor and respond to changes in traffic conditions, including both planned events and emergencies. Information is conveyed to the public via radio, the Internet, and through changeable message signs located throughout the freeway system. These capabilities allow Caltrans to respond quickly to incidents and allow the public to adjust their travel plans. In addition to these "hard-wired" systems, freeway, highway and arterial speeds and incidents are provided by cell phone providers and companies such as Google.

Arterial ITS systems are in place throughout the SCAG region as well. Local arterial systems include advanced signal synchronization capabilities to increase vehicular throughput which also have the ability to detect and respond to changes in traffic volume or direction of travel, and manage incidents. Like the freeway network, these systems include loop and video detection and also rely on wireless data such as that provided by Google.

TRANSIT

Most medium to large scale fixed-route and Dial-a-Ride operators have implemented four of the five transit ITS components, with the exception of TSP. TSP, however, is an integral part of Metro's Metro Rapid program that has 20 routes: Santa Monica's Big Blue Bus, Culver City Bus and Torrance Transit have Rapid lines that employ TSP as well. These TSP systems are a combination of hard-wired loop technology as well as wireless technology.

Metro has also implemented smart card technology through its "TAP Card" system. This includes most of the large municipal bus operators (Munis) in L.A. County that receive federal funding. Some have yet to implement the TAP system as expensive hardware upgrades are necessary such as fareboxes.

The region also has "5-1-1" traveler information systems in place (similar in concept to 9-1-1) administered by the CTCs which allow for a one-stop multi-media contact point for all traveler information services. The 5-1-1 system is part of a national initiative to create a national system of traveler information services.

RAIL

The Southern California Regional Rail Authority (SCRRA) implemented PTC for its entire system in 2015 — the first commuter railroad in the nation to do so. The two large freight companies in our region, BNSF and UP, are also in the process of implementing it.

There also are existing programs between Los Angeles and our region's railroads (SCRRA, UP, and BNSF) that implemented an interface standard between the rail warning circuit controller and traffic signal controller (this interface standard is known as IEEE 1570–2002) for the purpose of establishing a "supervised communication circuit." This standard has been promulgated by California Public Utilities Commission (CPUC), and is now reflected in both the Manual on Uniform Traffic Control Devices (MUTCD) and the American Railway Engineering and Maintenance-of-Way Association (AREMA). An extended application of this standard involves the application of Advance Preemption, which allows the traffic signal to complete the pedestrian timing for conflicting crosswalks prior to trains arriving at the rail crossing. This extension, however, requires the railroad circuitry be designed in such a way, or be modified. This extended application is now common for active signalized intersections near rail crossings, including light rail.

SCAG'S ROLE

SCAG has a critical role in the development and management of ITS in the region. As the MPO, SCAG is charged with developing and maintaining the Southern California Regional ITS Architecture. This architecture is the regional planning tool for ensuring a cooperative process to prioritize and deploy ITS technologies and for identifying critical data connections between institutional stakeholders. This architecture assists the region in deploying ITS systems that are truly integrated and able to share information among many agencies in consistent and compatible formats to achieve improved safety and efficiency of transportation operations. SCAG works closely with the CTCs, local governments and Caltrans Districts to update and maintain the regional architecture, and to assure the use of required systems, engineering requirements and applicable standards, which are required when federal funds are used on ITS projects.

EXISTING SYSTEM PERFORMANCE AND OPERATIONAL IMPACTS FROM ITS

ITS technologies are not a separate transportation mode, but they are a means of assuring that our existing transportation system is being managed and operated at maximum effectiveness to increase capacity. An example is ramp metering of freeways, which is designed to assess the optimal flow rate (highest achievable capacity) of the facility and adjusts freeway on-ramp metering to administer incoming vehicles in such a way that minimizes flow disruption to the freeway facility. Today, sub-optimal flow on our freeways and arterials, so-called "stop and–go traffic," creates significant losses to design capacity and contributes to time delays and economic loses to travelers. ITS technologies allow us to observe, confirm and proactively address these losses in operational efficiency. This allows for rapid response to clear incidents and accidents, adjust ramp metering rates, identify bottlenecks and slow approaching traffic to reduce collisions that would further diminish the system's optimal flow rate capacity. Similarly, traffic signal systems on arterials are monitored for the proper timing of signal phases, traffic volumes and changes on arterials, and optimal timing plans are introduced to maximize arterial flow and minimize unnecessary delay. In addition to freeway on-ramp metering, Caltrans has installed freeway-to-freeway metering in some locations such as the I–210 and SR 57, and the I–105 and I–605 interchanges.

FUTURE SYSTEM IMPROVEMENTS

ITS plays a critical role in the operation and management strategies designed to increase the efficiency of the existing transportation system. The 2016 RTP/SCS allocates $9.2 billion in TSM measures, which includes ITS.

The region will continue to update the capabilities of Caltrans TMCs, expand ramp metering and corridor management strategies, fill loop detection gaps, increase the use of signal system controls, and increase and improve the technical capabilities for transit bus and rail systems. ITS systems are not modeled directly as a mode in the regional travel demand model, but comparative studies of the impacts show significant travel time savings on arterials and highways, as well as improvement in the effective flow rates of our freeways. Transit ITS systems also help in increasing the OTP of public transit services through better scheduling.

ITS will play an increasing role in regional goods movement strategies. The Ports of Los Angeles and Long Beach are using ITS technologies, specifically AVL, as a major component in their highly successful air quality mitigation strategies. Advanced monitoring assists in achieving system efficiencies in the ports and intermodal operations, reducing delays and waiting times at gates and destinations, and allowing for more flexible dispatching, all of which reduce emissions. Weigh-in motion systems and enhanced detection will allow for better enforcement of commercial vehicles rules, reducing pavement damage and identifying critical paths for goods movement planning in the future. For more information on ITS strategies for goods movement, please see the Goods Movement Appendix.

ITS systems allow for enhanced capabilities to protect the transportation system and respond to emergencies. One goal of the 2016 RTP/SCS is to integrate transportation system information into a shared use capacity with emergency service responders. Visual safety systems, detection, AVL and the ability to share this information with public safety agencies will assist in deterring, preparing for, responding to and recovering from manmade security events and natural disasters. These technologies, although in place to manage the transportation system, can assist in providing a deterrence to crime and terrorism, as well as assist in major incident responses such as road closure or other events requiring the close coordination of evacuation vehicles.

RECOMMENDED STRATEGIES

Maintain and update the Regional ITS Architecture to ensure eligibility of federal funding from state-of-the–art ITS technologies for regional stakeholders.

- Continue the development of a Regional Configuration Management process among CTCs, Caltrans Districts, ports and local governments to ensure consistent and compatible integration of ITS technologies and interoperable operations.
- Identify funding sources for transportation system operations and management strategies, including ITS, to ensure optimal operation of the existing and future transportation system in the region. This will be coordinated with the CTCs, Caltrans and other agencies implementing ITS technology.
- Implement near-term ITS priorities to improve the safety and efficiency of the current transportation system, including ramp metering, increased freeway detection, monitoring of goods movement operations, advanced traveler information systems/5-1-1/goods movement information systems, transit vehicle location and real-time schedule adherence, Rapid Bus systems, computer-based signal timing systems, interconnection between roadway traffic signals and railroad signal systems, automated fare collection, and toll collection technologies.
- Identify ITS base systems for future integrated freeway and corridor management strategies, including potential congestion pricing systems and High Occupancy Toll Lanes.
- Mainstream ITS investments and make ITS systems part of the capital investment in new projects to ensure optimal operations of new transportation investments.

TRANSPORTATION DEMAND MANAGEMENT

Transportation Demand Management (TDM) and the related TSM rose to prominence in the 1970s and 1980s as cost-effective alternatives to road capacity expansions. TDM strategies are of two kinds: voluntary, or "soft," strategies — such as preferential parking for carpoolers — that aim to lure some to alter their travel behavior in response to voluntary inducements, and "hard" strategies — such as increased parking pricing — that shift the behavior of a large number of travelers by changing the price of travel. TDM also can include regulatory strategies, such as regional employer ridesharing mandates. The SCAG region has been home to some of the more innovative and successful TDM efforts over the years. Some examples include rideshare programs, parking cash out and park-and-ride lots.

Careful evaluations of these and other efforts around the U.S. have shown that soft TDM strategies can be very effective in reducing SOV travel at the scale of a large employment site. However, that the staying power of soft TDM strategies can fade over time without constant attention from employers or the accompaniment of hard TDM strategies. Hard TDM strategies, such as road and parking pricing, have been shown to influence travel behavior more durably and, depending on the application, over much larger geographies.

This does not mean that soft TDM strategies should be dismissed and hard TDM strategies implemented. Precisely because the effects on travel behavior are so significant, hard strategies can be controversial and require significant analysis, consensus building and public education prior to implementation. However, pricing benefits have proven to be more sustainable over time and complement the integrated land use strategies adopted by the region.

In general, TDM strategies complement each other. More employees might use a transit subsidy or carpool and vanpool if a guaranteed ride home (GRH) program were in place in the event of a family emergency or unscheduled overtime. If the employer were to also implement a parking cash-out program, the number of transit users would likely increase further.

Effective TDM programs can increase choices for travelers, and reduce per capita non–renewable energy consumption and emissions. When transit usage, carpooling, biking and walking increase, transportation system efficiency tends to increase, bringing many benefits to the region. Therefore, these benefits can justify substantial public expenditures on effectively implemented soft TDM programs, even absent regional congestion benefits. This appendix outlines the TDM strategies that the SCAG region has committed to investing in the 2016 RTP/SCS.

In summary, the 2016 RTP/SCS commits $6.9 billion to fully implement TDM strategies throughout the region, which is a $2.4 billion increase from the 2012 RTP/SCS. There are three main areas of focus:

- Reduce the number of SOV trips and overall VMT through ridesharing, which includes carpooling, vanpooling and supportive policies for ridesourcing services such as Uber and Lyft.
- Redistribute or eliminate vehicle trips from peak demand periods through incentives for telecommuting and alternative work schedules.
- Reduce the number of SOV trips through use of other modes of travel such as transit, rail, bicycling and walking.
- In addition, the following strategies expand and encourage implementation of TDM strategies to their fullest extent.
  - Rideshare incentives and rideshare matching
  - Parking management and parking cash-out policies
  - Preferential parking or parking subsidies for carpoolers
  - Intelligent parking programs
  - Promotion and expansion of Guaranteed Ride Home programs
  - Incentives for telecommuting and flexible work schedules
  - Integrated mobility hubs and first/last mile strategies
  - Incentives for employees who bike and walk to work
  - Investments in active transportation infrastructure
  - Investments in Safe Routes to School programs and infrastructure

RIDESHARING

The SCAG region continues to invest heavily in High Occupancy Vehicle (HOV) and Express Lane (High Occupancy Toll) infrastructure, which provide incentives for commuters to share rides with others or take express transit services. CTCs and large employers in our region provide carpool and vanpool matching services and sometimes subsidies. Many large employers have GRH programs to act as an additional incentive for employees to carpool and vanpool. If they need to get home early due to an emergency of for some other reason, or have to stay late, they don't have to worry about not having their car at work.

CARPOOLING AND VANPOOLING

Carpooling is when two or more people share a ride, traditionally to work, but also for other trip purposes. Carpooling has been a TDM strategy for a long time, and can save people significant amounts of financial resources because one car is being used instead of two or three. In the case where two people would be using two cars for the same trip, VMTs are reduced by half, with the resulting decrease in congestion and air pollution and VMTs. CTCs in our region provide carpool matching services through their 511 databases. Many employers also provide employees with a financial incentive such as a monthly stipend. The 2016 RTP/SCS assumes a $1.2 billion incentive pilot program beginning in 2035 and extending five years to 2040. This incentive program will encourage carpooling by providing an average subsidy of $5 per parking space, resulting in more than 436,000 trips reduced per day.

Vanpooling is similar to carpooling, but vanpools generally involve more people. A vanpool is usually a group of five to 15 people who regularly travel together to work typically about 30 miles or more (roundtrip) in a comfortable van at least 13 days out of the month. Typically, riders pay a monthly fare and maintenance fee, while drivers ride at a discounted rate in exchange for driving and maintaining the van. Many employers and CTCs have vanpool programs and subsidize them. All six counties in the SCAG region have vanpool programs subsidizing more than 2,000 vanpools as of the beginning of 2015. Subsidy rates typically range from 20 percent to 50 percent of the vanpool lease cost, or up to $400.00 in the case of Los Angeles and Orange counties.

CARSHARE

Carshare involves membership-based programs in which individuals can sign up to have hourly access to a pool of vehicles and then return them to the same or a different place from where they were picked up. Unlike traditional car rentals, vehicles can be picked up at designated spots around the city, usually in public parking lots. Zipcar, recently acquired by Avis, is one of the more popular roundtrip platforms. One-way carshare allows members to take a vehicle and leave it at a different station, or anywhere within allowed boundaries. Zipcar recently added one-way service, and a new company, Car2go, has launched programs in San Diego and is looking to provide services in Long Beach and Los Angeles in our region.

There is also a new business model involving individuals with private cars who rent them out for certain periods of the day or month. Companies such as RelayRides and Getaround are facilitating this service. The most quoted analysis of the impact of carshare services shows that 9 to 13 vehicles are taken off the road for each car sharing vehicle.

SCAG and its partners will strengthen their efforts to encourage ridesharing and other trip reducing strategies that aim to reduce vehicle trips, energy consumption, air pollution and greenhouse gas emissions. Among these efforts are to:

- Encourage local governments to require parking cash out programs, where feasible.
- Encourage cities to reconsider minimum parking requirements in zoning ordinances.
- Encourage the development and viability of Transportation Management Organizations/Agencies at major employment locations throughout the region.
- Program public funds in the FTIP to educate employers and expand the GRH Program.
- Provide seamless intra- and inter-county vanpool and carpool services to the regional traveler.
- Encourage park-and-ride lots along suburban corridors, and in bedroom communities.
- Identify current dedicated funding sources and work with CTCs and partners on identifying additional new funding sources.
- Increase the number of commuter vanpools through more effective marketing and the provision of non-monetary public sector incentives.
- Maintain and sustain a regionally coordinated marketing strategy among the public and private sectors to enhance vanpool programs, increase ridership and improve outreach efforts.

INTELLIGENT PARKING

Intelligent parking assists drivers in efficiently locating parking spots through ITS and smart phone apps. Through a smart phone app, a driver can locate vacant or soon-to-be-vacant parking spots in parking facilities such as structures and on-street parking managed by cities. Intelligent parking can:

- reduce traffic congestion;
- decrease air pollution and greenhouse gas emissions; and
- improve safety (because drivers are not distracted by hunting for spaces).

Intelligent parking can also increase the supply of parking through variable peak-period pricing. This variable peak-period pricing, coupled with advance information about parking availability, may encourage a mode shift to transit or active transportation as drivers determine that the price is to too high or learn in advance the challenge of finding available parking. In addition to parking location and supply information, intelligent parking smart apps can allow drivers to purchase parking remotely through their smart phones.

Intelligent parking includes Automated Parking, which improves the efficiency of parking structures by increasing capacity versus conventional parking structures. While increasing parking supply alone could result in an increase in personal vehicle trips, it reduces the need for conventional parking spaces in high parking demand areas, thereby freeing much–needed real estate for other uses. Automated parking systems can be implemented with intelligent parking and pricing to minimize negative externalities associated with increasing parking supply.

TELECOMMUTING/WORK–AT–HOME/FLEXIBLE WORK SCHEDULES

Increasing the number of workers who work-at-home (self-employed, home-based business owners) or who telecommute/telework (wage and salary employees conducting some or all of their work from home or remotely) decreases home-based work trips, VMT, congestion, air pollution and greenhouse gas emissions.

Telecommuting/teleworking can be defined as working outside the traditional office or workplace, usually at home, but also remotely while traveling, at client/customer workplaces, libraries and other Internet accessible locations. Once thought of as a "magic bullet" for solving congestion problems, telecommuting is now seen as one of many TDM strategies to reduce congestion.

Flexible work schedules involve adjusting the hours an employee works, for example working 7:00 a.m. to 3:30 p.m., or 10:00 a.m. to 6:30 p.m. instead of 9:00 a.m. to 5:30 p.m. It also includes 9/80 and 10/40 schedules, during which employees work nine, nine-hour days per pay period or eight, ten-hour days per pay period.

According to GlowbalWorkplaceAnalytics.com:

- 2.6 percent of the U.S. employee workforce (3.3 million people, not including the self–employed or unpaid volunteers) considered home their primary place of work.
- The number of days per week that employee teleworkers (not including self–employed) telecommuted increased 79.7 percent from 2005 to 2012, although the rate of growth slowed during the recession.
- While telecommuting grew by 3.8 percent from 2011 to 2012, the size of the overall non–self–employed workforce actually declined 1.5 percent. For the period from 2005 to 2012, the telecommuter population grew by 79.7 percent while the non-self-employed workforce grew by only 7.1 percent.
- The region with the fastest percentage growth in regular employee telecommuting was the Inland Empire, posting a 77 percent increase since 2005 (based on growth relative to the local total population; among populations with over 1 million workers).

In the SCAG region, about 5.0 percent of all workers telecommute or work from home on a daily basis according to the American Communities Survey (ACS). Separating out the self-employed, the number of full-time telecommuters in the SCAG region is closer to 2.6 percent percent for 2013. Currently, telecommuting is limited to "knowledge-based" workers including some management functions. However, knowledge based workers exist in most industries, allowing some occasional telecommuting.

Various barriers exist that are likely slowing down the growth of increased telecommuting. In a 2001 report, the Government Accountability Office (GAO) reported several barriers to telecommuting that could slow its growth. In summary, various laws and regulations put in place before the advent of telecommuting create challenges, particularly potential state tax effects and related administrative burdens arising from interstate telecommuters, and uncertainty surrounding employer responsibility to provide safe workplaces when it involves home offices.

The GAO identified the following barriers:

- Management concerns about supervising remote employees
- Security/privacy concerns
- State tax laws (when crossing state boundaries) and their impact on corporate tax rate, individual taxes and sales tax application
- Applicability of potential Occupational Safety and Health Administration (OSHA) requirements and/or Americans With Disabilities Act (ADA) compliance
- Workers' compensation costs
- Injuries at work, regardless of location, are covered under workers' compensation
- Injuries at a home office are not usually witnessed, raising concerns about whether they are work-related
- The reasonable accommodation provision of ADA may require employers to pay for modifications to home offices or equipment
- Employers must not discriminate against non-disabled employees in establishing telecommuting programs
- Employees face complicated rules pertaining to home office tax deductions, federal and state wage laws, workers compensation, etc.
- The Fair Labor Standards Act establishes overtime and record-keeping requirements for the vast majority of workers
- Some categories of workers are exempt from the law (e.g., executive, administrative or professional positions)
- Most telecommuters may be exempt employees

Some literature argues that while flexible work schedules and telecommuting may reduce (or, in the case of satellite offices, reroute) SOV commute trips, it may actually increase SOV trips for other trip purposes, such as errands and trips for lunch while an employee is working from home (although not necessarily during peak congestion periods). It is also contended that telecommuting may encourage people to live farther from their workplaces than they would otherwise. It is assumed that these additional trips may be roughly six miles per day. SCAG estimates that 25 percent of total VMT saved through telecommuting is lost through these extra trips.

Based on ACS estimates for non-self-employed workers, the telecommute rate grew from 1.8 percent of all workers in 2007 to 2.6 percent in 2013. As baby boomers continue to retire in increasing numbers, the average age of our region's workforce will decrease at a higher rate than ever before. As younger, generally more tech-savvy workers take over the workforce and employers continue to embrace remote access capabilities where practical, we can expect to see a renewed increase in the percentage of workers who telecommute. This trend, together with 2016 RTP/SCS strategies and incentives designed to promote telecommuting, are expected to increase the overall telecommuting rate to 10 percent by 2040. Among these strategies are to:

- Support and encourage ubiquitous high-speed internet access throughout the region
- Recommend changing taxation policies that might discourage working at home/telecommuting
- Promote how telecommuters can easily meet OSHA/ADA compliance via self-certification

- Encourage revising workforce safety/fair labor standards to better reflect working away from a central location

According to the 2010 AQMD Rule 2202 Employee Commute Reduction Program (ECRP) survey, four percent of all workers in the air basin utilized a flexible work schedule in 2008. A 2014 national study of employers by the Families and Work Institute and the Society for Human Resource Management showed that the percentage of employers allowing a compressed work week grew from 38 percent in 2008 to 43 percent in 2014. Employers are becoming more likely to provide flex time and place and more choices in managing work time, without a loss in pay. These trends, together with 2016 RTP/SCS strategies and incentives to promote flexible work schedules, are expected to increase the overall use of flexible work schedules to 15 percent by 2040.

TRANSIT AND RAIL

Changes in land use patterns around our transit investments, referred to as Transit Oriented Development (TOD), reduce SOV travel and VMT through increased transit use and active transportation, and provide better access to local jobs and services. Many TOD projects have been built in our region since the 2012 RTP/SCS, and many more are under construction and planned. These projects will play a significant role in reducing SOV travel and VMTs.

Significant transit investment has been made since the 2012 RTP/SCS, primarily based on voter-approved county sales tax measures. Following are major transit projects in various stages of planning and construction:

- Purple Line extension to Westwood
- Gold Line extension to Montclair (2B) and Ontario International Airport (2C)
- Speed and service improvements on the LOSSAN Corridor and Metrolink Network
- CA High-Speed Train Phase One
- Metrolink San Jacinto extension
- OC Streetcar
- Anaheim Rapid Connection Streetcar
- New BRT and BRT Lite services in Orange, Riverside and San Bernardino Counties
- Redlands Rail

In addition to current commitments, SCAG is recommends the following:

- Increase service in productive corridors
- New point-to-point express bus service in key corridors
- New Bus Rapid Transit (BRT)/BRT Lite in key corridors

Some of the benefits of investing in transit and rail are:

- New and enhanced transit services that provide new commute choices for commuters and residents
- Cleaner air and reduced congestion, Vehicle Miles Traveled (VMTs) and greenhouse gas emissions.
- Facilitation of current and future smart growth and sustainable communities
- The ability of residents to choose a healthier, more active lifestyle
- The ability of residents who do not own a vehicle to remain mobile and active

ACTIVE TRANSPORTATION AND FIRST/LAST MILE

First /last mile strategies are designed to increase the range and accessibility of transit and rail stations by increasing and enhancing bike and pedestrian facilities to them, and providing alternatives to access transit and rail stations other than driving alone. Strategies include adequate sidewalk facilities, bike facilities such as bike lanes and lockers, and bike sharing and ridesourcing services such as Uber and Lyft. These strategies can increase the effective catchment areas of transit and rail stations from less than ¼ mile to ranges considerably greater. Many cities in our region are implementing first/last mile strategies. SCAG partnered with Metro on its 2015 First/Last Mile Strategic Plan that examines different rail and transit station types to develop recommendations tailored toward these particular station types. The result is that the most effective strategies can then be implemented where they are the most effective and economically feasible. Also, in 2013, OCTA completed the Non-motorized Metrolink Accessibility Strategy to identify first/last mile active transportation improvements at each of Orange County's 11 Metrolink stations. For a more detailed discussion of active transportation and first/last mile strategies, please refer to the Active Transportation Appendix.

BIKE SHARE

Bike Share is a service in which bicycles are made available for shared use to individuals on a short-term basis from one point to another. Many bike share systems offer subscriptions that make the first 30-45 minutes of use either free or very inexpensive, encouraging bicycling for short trips. This allows each bike to serve several users per day. Bike share systems also include smartphone apps to show nearby stations with bike and dock availability. Our region is lagging in implementing bike share, when compared with other metropolitan areas in the nation. The City of Santa Monica is implementing its bike share program in early 2016, and Metro will roll out its county system in 2016–2017.

SHORT TRIP STRATEGIES

The 2016 RTP/SCS Short Trip Strategies represent a set of state and local policies to encourage the use of alternative modes of transportation for short trips. In the U.S., nearly 40 percent of urban and suburban auto trips are less than two miles, and in Los Angeles County 34 percent of trips are under one mile. These statistics demonstrate the need to invest in first/last mile infrastructure, including improved active transportation facilities and especially bike share.

The 2016 RTP/SCS Short Trip Strategies will be applied to a selection of geographically defined areas and includes the following policies:

- Definition of Short Trip Strategies
- Application of robust complete street policies
- Reallocation of roadway space to active transportation facilities
- Significant implementation of bike share stations in Short Trip Concept Areas
- Policies that support increased TOD

The SCAG region is investing $12.9 billion in active transportation projects as part of the 2016 RTP/SCS. The active transportation plan has six specific strategies for maximizing Active Transportation in the SCAG region in two broad categories, short trips and regional trips. All six strategies are based on a comprehensive local bikeway and pedestrian network, using complete streets principles. These strategies include:

Short Trips:

- Local Bikeway Networks
- Bike Share
- Livable Corridors/Short Trip Strategy

Regional Trips:

- Regional Bikeway Network
- Regional Greenway Network
- First/last mile (to transit)

LOCAL BIKEWAY NETWORK

Where the Regional Bikeway Network and Regional Greenway Network focus on regional connectivity, local bikeway networks focus on increasing the density of bikeways in the region. This density provides the starting points and end points for all bikeway trips in the region. The majority of the existing bikeways in the region are comprised of local networks.

The local bikeway network is the foundation for the regional bikeway network and the regional greenway network, as they are mostly comprised of local bikeways.

Local governments are responsible for implementing most transportation infrastructure. Just over 4,800 miles of local bikeways exist in 2012, and local governments have proposed an additional 8,091 miles. This density of bikeways is likely to have an increasingly positive impact on the number of bicyclists and bicyclist trips. Anecdotal evidence from New York City and other cities indicate that an increased density of bikeways increases transportation safety. Streets with bike lanes in New York City have a 40 percent less serious injury and fatality collisions.[4]

REGIONAL BIKEWAY NETWORK

The Regional Bikeway Network (RBN) is a 2,220 mile system of interconnected bike routes of regional significance. The RBN connects cities and counties and serves as a spine for local bikeway networks and the regional greenway network. It includes on-road and off-road facilities that link major origins and destinations directly, or through connectivity to the high quality transit service.

The primary purpose is to serve regional trips, commuting and recreational bicycling. Using locally existing and planned local bikeways as the foundation, the RBN closes gaps, connects cities and provides a regional "backbone" for local bikeways and greenways. By having assigned route names/numbers, bicyclists can more easily travel across jurisdictions without having to frequently consult maps or risk having bikeways end on busy streets. It is anticipated that trips longer than 3 miles will likely be used in part on the RBN. The ultimate decision on final route locations and bikeway type rests with local jurisdictions.

SCAG recommends the following active transportation strategies and goals:

- Increase active transportation options for trips less than three miles.
- Increase dedicated funding for active transportation infrastructure.
- Decrease bicycle and pedestrian fatalities and injuries.
- Connect all cities in the SCAG region through a regional bikeway network with uniform signage.
- Increase the existing network of about 4,800 miles of bikeways to about 8,100 miles.
- Implement all local bicycle/pedestrian plans.
- Encourage local jurisdictions to prioritize improvements to comply with ADA requirements.
- Encourage local jurisdictions to prioritize active transportation needs of the growing number of senior citizens, including access to transit.

- Encourage the use of intelligent traffic signals that can detect slower pedestrians in signalized crosswalks and extend the signal time appropriately.
- Encourage local jurisdictions to adopt and implement complete streets policies.
- Construct cycle tracks where feasible in place of Class 2 or Class 3 bike facilities.
- Development of bicycle boulevards as a method of traffic calming.
- Installation of triple racks on buses.
- Support of folding bikes on transit.
- Increase the availability of convenient, secure bicycle parking.
- Support the use of signage to guide bicyclists to secure bicycle storage facilities in major employment areas.
- Support the development of bicycle facilities that provide access to and from major transit centers.
- Adoption of complete streets policies.
- Implement pedestrian improvements at least one mile from major transit stations.
- Implement mid crossing sanctuaries where appropriate to improve pedestrian safety.
- Encourage street design standards that increase pedestrians' personal security.

LAND USE

The Baseline Growth Forecast in the 2016 RTP/SCS links housing to transportation planning, considering both needs simultaneously. SCAG undertook a regional growth forecast effort to provide the foundation for the 2016 RTP/SCS and the Regional Housing Needs Assessment for the next housing element cycle. Forecasts for the October 2013 through October 2021 planning years were developed through a bottom-up approach, wherein SCAG staff worked with local jurisdictions to attain the most up to date data.

This approach ensures that the resulting assumptions are consistent with planned transportation infrastructure. The baseline growth forecast provides the basis for developing the land use assumptions at the regional and small-area levels which build the 2016 RTP/SCS Plan Alternative.

SUSTAINABILITY PROGRAM

SCAG has implemented various projects and programs that are coordinated to the development of the 2016 RTP/SCS. Over the last two years, SCAG has funded 77 sustainability projects throughout our region. These projects cover transit, rail, active transportation, sustainability and public health programs. These planning projects are scattered throughout our region at various cities and counties.

HIGH-QUALITY TRANSIT CORRIDORS (HQTCS) AND MAJOR TRANSIT STOPS

The 2016 RTP/SCS is placing a major emphasis on transit-orented development (TOD) and smart growth projects around HQTCs and major transit stops. A HQTC is a corridor with fixed route bus service with service intervals no longer than 15 minutes during peak commute hours. A major transit stop is a transit stop that is a rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon peak commute periods.

The Sustainable Communities and Climate Protection Act of 2008 (Senate Bill 375, Chapter 728, statutes of 2008), provided for residential or mixed-use residential projects that may be exempt from, or subject to a limited review of, the California Environmental Quality Act (CEQA). The bill specifically states that these "transit priority projects" should:

- contain at least 50 percent residential use, based on total building square footage and, if the project contains between 26 percent and 50 percent nonresidential uses, a floor area ratio of not less than 0.75;
- provide a minimum net density of at least 20 dwelling units per acre; and
- be within one–half mile of a major transit stop or high-quality transit corridor (HQTC).

A project is considered to be within one-half mile of a major transit stop or HQTC if all parcels within the project have no more than 25 percent of their area farther than one-half mile from the stop or corridor and if not more than 10 percent of the residential units or 100 units, whichever is less, in the project are farther than one-half mile from the stop or corridor.

SB 743 was signed into law in 2013 and provides further opportunities for CEQA exemption and streamlining to facilitate TOD. Specifically, certain types of projects within "transit priority areas" (TPAs) can benefit from a CEQA exemption if they are also consistent with an adopted specific plan and the regional Sustainable Communities Strategy (SCS). A TPA is an area within one–half mile of a major transit stop that is existing or planned, if the planned stop is scheduled to be completed within the planning horizon included in a Transportation Improvement Program adopted pursuant to Section 450.216 or 450.322 of Title 23 of the Code of Federal Regulations. In addition, aesthetic and parking impacts of certain infill projects within a TPA shall not be considered a significant impact on the environment. Finally, SB 743 also provides congestion management plan relief for a larger infill opportunity zone.

NEW INFRASTRUCTURE

The 2016 RTP/SCS contains $556.5 billion of transportation Improvements to the SCAG region. For more information and a list of projects, please refer to the Active Transportation, Goods Movement, Passenger Rail and Transit Appendices.

Major projects include:

- Speed and service improvements on the Metrolink and Pacific Surfliner corridors
- CA High-Speed Train Phase One
- New Los Angeles County Metro Rail lines and extensions
- Redlands Rail in San Bernardino County
- OC and Anaheim Rapid Connection Streetcars in Orange County
- Hemet/San Jacinto Metrolink extension in Riverside County
- New BRT and BRT Light services region-wide
- SCAG Regional Bikeway Network

THE FEDERAL TRANSPORTATION IMPROVEMENT PROGRAM (FTIP) – SINGLE OCCUPANCY VEHICLE (SOV) CAPACITY–ENHANCING PROJECTS

All federally funded congestion relief strategies (projects and programs) are programmed into the Federal Transportation Improvement Program (FTIP) in the SCAG region. Under state law, the Congestion Management Program projects must be incorporated into the FTIP in order to receive federal and state funds.

In non-attainment and maintenance areas, the FTIP projects as a whole, including congestion relief projects, must be analyzed for the Transportation Conformity requirements. In project-level analysis, the projects requiring federal action (funding or approval) are subject to environmental impact study (EIS) through the National Environmental Policy Act (NEPA). This is an evaluation and analysis of the alternatives. The selected alternative will be incorporated into the FTIP for implementation.

The federal government regulates the monitoring of projects that significantly increase SOV capacity in the region through 23 CFR§450.320 subsections d and e, which states, in part:

"In a TMA designated as non–attainment area for ozone or carbon monoxide pursuant to the Clean Air Act, Federal funds may not be programmed for any project that will result in a significant increase in the carrying capacity for SOVs (i.e., a new general purpose highway on a new location or adding general purpose lanes, with the exception of safety improvements or the elimination of bottlenecks), unless the project is addressed through a congestion management process meeting the requirements of this section.

In TMAs designated as non-attainment for ozone or carbon monoxide, the congestion management process shall provide an appropriate analysis of reasonable (including multimodal) travel demand reduction and operational management strategies for the corridor in which a project that will result in a significant increase in capacity for SOVs (as described in paragraph (d) of this section) is proposed to be advanced with Federal funds.

All identified reasonable travel demand reduction and operational management strategies shall be incorporated into the SOV project or committed to by the State and MPO for implementation.

MONITORING PROJECTS FOR COMPLIANCE WITH THE CMP

SCAG previously used a $50 million threshold to identify projects to increase SOV capacity, but the agency is replacing this criterion with the following process for the 2016 RTP/SCS and 2017 FTIP:

1. Identify all SOV capacity increasing projects that are fully or partially funded by federal sources.
2. Identify and determine projects that are 1) safety and/or operational improvements and 2) bottleneck relief projects, as these are exempted from the CMP process.
3. Identify SOV capacity increasing projects that are at least one mile in length, as this is the primary criterion that determines the need for CMP review.
4. Collect from the SOV capacity increasing project sponsors documentation upon project submittal that demonstrates that alternative TSM/TDM strategies were considered for the project in question during the alternatives analysis process. Acceptable documentation includes:
   - Alternatives Analysis study and/or other relevant project planning study with specific reference to the TSM/TDM strategies
   - Environmental Impact Statement/Environmental Impact Report (EIS/EIR)
   - Statement of overriding consideration explaining why consideration of TSM/TDM strategies were irrelevant, infeasible or impractical (e.g., arterial widening in rural area)
5. Create list of all SOV capacity increasing projects subject to the CMP. The list will include a description of the project along with its submitted documentation with a link.

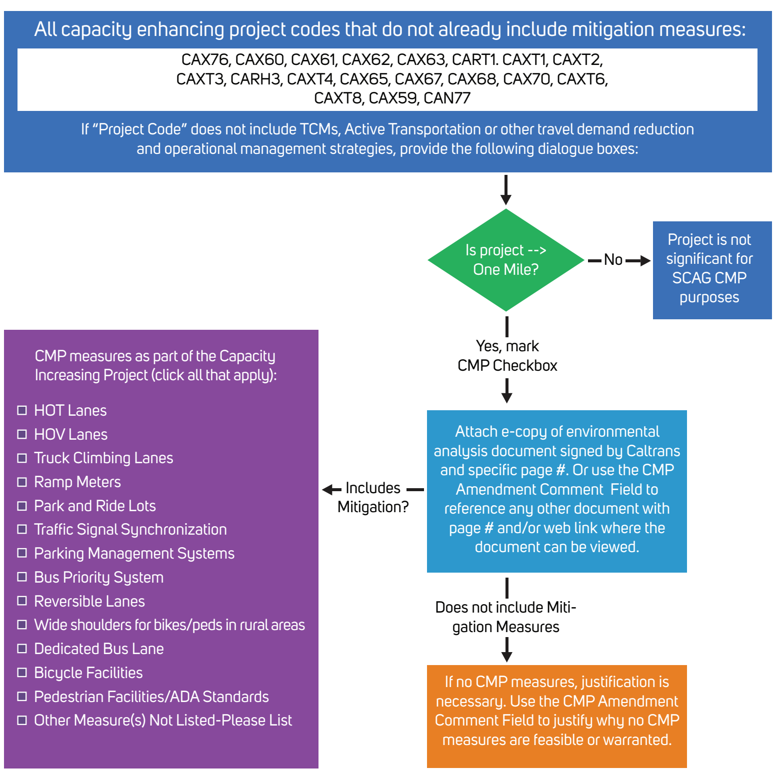
All SOV capacity increasing projects will be incorporated in to an appendix of the 2017 FTIP, as well as listed on SCAG's CMP website.

Below is a flowchart showing the required information needed for projects subject to the CMP:

CONGESTION MANAGEMENT UNDER MAP-21

MAP-21, the Moving Ahead for Progress in the 21st Century Act (P.L. 112-141), was signed into law in 2012. It transformed the framework for national investment in transportation by creating a performance-based surface transportation program. MAP-21 focused the federal-aid program on several national goals, including congestion reduction. The United States Department of Transportation (USDOT) is required to establish performance measures for states and Metropolitan Planning Organizations (MPOs) to use to assess the performance of the interstate and national highway systems.

FIGURE 7 FTIP Congestion Management Process



As part of this performance-based approach, a Metropolitan System Performance Report is required as part of the RTP/SCS. MPOs must evaluate the condition and performance of the transportation system, document the progress achieved in meeting performance targets, evaluate how the plan preferred scenario has improved conditions and performance (where applicable), and evaluate how local policies and investments have impacted costs necessary to achieve performance targets (where applicable).

Additionally, a Congestion Mitigation and Air Quality Improvement (CMAQ) Performance Plan must be developed every two years, to report on progress towards the achievement of targets. Performance measures will be established to assess traffic congestion and on-road mobile source emissions.

At the time this document was being prepared, the federal rulemaking process to implement MAP–21 was not yet complete. SCAG will continue to monitor rulemaking to understand the implications for the RTP/SCS and the CMP, and take the necessary steps to fully evaluate the final rule. In December 2015, the Fixing America's Surface Transportation Act, or "FAST Act," was signed into law. The FAST Act amends Section 134 of title 23, U.S. Code, by adding that "a metropolitan planning organization serving a transportation management area may develop a plan that includes projects and strategies that will be considered in the TIP of such metropolitan planning organization." As with MAP-21, SCAG will monitor the rulemaking process to implement FAST Act provisions. Moving forward, SCAG will also continue to coordinate with the CTCs regarding their countywide Congestion Management Programs, to ensure that the data collection and reporting on county roadway and transit networks can support the new MAP–21 reporting requirements for system performance. SCAG will also work with the CTCs and Caltrans to seek opportunities to evaluate and document the effectiveness of congestion management strategies to improve the knowledge base for congestion reduction strategies.

CMP TOOLBOX AND STRATEGIES

The SCAG CMP Toolbox contains strategies, summarizes potential costs and benefits, and lists performance measures and metrics. The Toolbox contains both TDM and TSM strategies. In addition, complementary strategies are listed that may increase the effectiveness of various strategies.

TABLE 6 CMP Toolbox and Strategies

CMP Toolbox – Carpooling/vanpooling	
TDM: Carpooling and Vanpooling present a cost effective way to decrease congestion by using the available seating capacity in vehicles.	
Carpooling and Vanpooling – An arrangement where several participants travel together in one vehicle, often sharing costs or taking turns as the driver. Can be formalized with dedicated vanpools.	
Pros: • Reduces costs to participants • Reduces SOVs on roadways during peak periods • Reduces amount of pollution released • Reduces travel time	**Cons:** • Requires punctuality of participants • Reduces ability to run errands • Only suitable for prescheduled trips, such as commuting
How measured: Average Vehicle Occupancy (AVO): Can be performed through visual counts on roadways, employer surveys (some surveys done annually by South Coast Air Quality Management District).	
Examples of quantifiable performance goal (measured by AVO): • AVO >1.5 (example)	• Average travel speed • Increase carpooling by 20% over base year by the year 2040
Implementation costs: • Promotion and monitoring • Necessary complementary strategies can add costs	**Congestion impacts:** • Directly impacts congestion on a 1:1 basis
Complementary Strategies: • Carpool subsidies • Ride matching services • Guaranteed ride home program • Carpool matching software • Preferential parking • Parking cash out	• Carpool exemption for ramp meters • HOV lanes • Toll road exemptions for vanpools • Trip reduction ordinances • Congestion pricing/parking pricing strategies • Park and ride facilities
Responsible agency(ies): Employers, transportation management agencies, county transportation authorities, cities, air quality management districts	
Primary stakeholders: • Employers • TMAs/TMOs • Carpooling/ridesharing organizations	**Secondary stakeholders:** • News media • Law enforcement (HOV lane violations) • Parking lot owners/operators

Sources: *Carpool Ride Matching Service; http://www.carpoolconnect.com/*
TDM Encyclopedia; http://vtpi.org/tdm/tdm34.htm
Sustainable Environment for Quality of Life; http://www.seql.org/Carpool%20Vanpool.pdf
Environmental Protection Agency Carpool Incentive Programs:
Implementing Commuter Benefits under the Commuter Choice Leadership Initiative

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Parking Cash Out

TDM: Employer paid parking subsidizes the cost of driving. By separating the cost of parking from a business, travelers have incentives to use other modes.

Parking Cash Out – An employer–funded program where an employer offers to provide a cash allowance to an employee equivalent to the parking subsidy that the employer would otherwise pay to provide the employee with a parking space.

Pros:	Cons:
• Reduces costs for employer • Provides "extra" money for employee • Can provide more area for development/business use if business owns parking lot/structure	• Other modes of transportation must be available in order for it to be effective • Works best when employer leases parking lot (vs. owning lot) • Excessive parking infrastructure already in place

How measured: Surveys of businesses or business areas

Examples of quantifiable performance goal: Reduce the number of cars parking in area A during normal employment hours by 10 percent from the base year. Change in 25% of employees using other modes by 2040 to 10% employees using other modes in 2012.

Implementation costs:	Congestion impacts:
• Minor costs to have payroll system accounts reflect parking cash out program and any tax benefits • Necessary complementary strategies can add costs	• Santa Monica reported a 17% reduction in parking and a 7% reduction in SOV travel (1998).

Complementary Strategies: Transit subsidies, carpool and vanpool subsidies, carpool and vanpool preferred parking; bicycle racks/lockers

Responsible agency(ies): Employers

Primary stakeholders:
- Employers
- TMAs/TMOs
- Cities

Local Case Study:
- California AB 2109 requires employers of 50 or more employees who lease their parking to offer parking cash out.
- Santa Monica requires parking cash out under Ordinance 1604 and requires employers eligible under AB 2109 to implement a parking cash out program.

Sources: *California Air Resources Board Parking Cash Out Incentives: Eight Case Studies 1998 US Environmental Protection Agency Parking Cash Out: Implementing Commuter Benefits as One of the Nation's Best Workplaces for Commuters 2005.*

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Parking Management	
TDM – The cost and availability of free parking is the second greatest influence on travel behavior behind the cost of gasoline.	
Parking Management – The systemic influencing of transportation mode choices in a particular area by limiting the availability of parking, either through the reduction of available parking, or by increasing the costs of parking.	
Pros: • Reduced congestion • Increased air quality	**Cons:** • Imposing fees on what has traditionally been seen as free to the consumer may be politically unpopular • Needs range of transportation options available (e.g.,bus, subway, rail)
How measured: Increase in transit ridership, number of carpoolers and vanpoolers, number of people biking	
Examples of quantifiable performance goal: Reduce the number of SOVs in the downtown area by 90% from 2012 to 80% by 2040. • Average parking lot utilization • Percentage of SOV parking utilization	
Implementation costs: • Carpool/vanpool parking signs ($500/ea) • Electronic parking availability signage	**Congestion impacts:** • Can reduce congestion caused by drivers looking for free street parking
Complementary Strategies: • Intelligent parking management systems • Intelligent parking meters • Parking cash out • Increased parking fees	• Reduced parking fees/preferential parking for carpools/vanpools • Reduced parking requirements • Shared parking across buildings
Responsible agency(ies): Employers, parking lot owners/operators	
Primary stakeholders: • City government • County government • TMAs/TMOs	• Parking management companies • Building owners/management

Sources: http://www.ops.fhwa.dot.gov/publications/fhwahop10010/presentation.htm
Traffic Incident Management Handbook; http://ntl.bts.gov/lib/jpodocs/rept_mis/13286.pdf

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Pedestrian Improvements	
TDM: Pedestrian Infrastructure Investments – Developing pedestrian facilities to reduce motorized vehicle use for short (<1/2 mile) all–purpose trips and linkages to transit.	
Pros: • Reduced congestion • Reduced emissions • Reduced capital expenditures • Improved Public Health	**Cons:** • May not be effective for some communities • Some older non–standard roadways may require sidewalk widening or innovative solutions to be effective
How Measured? Pedestrian level of service criteria: Qualitative criteria to determine how desirable an area is for walking, including sidewalk width, ADA compliance, safety, street life, social amenities, senior citizen security and comfort. Walk Score: An internet tool that gives a score based on the number and type of amenities within a certain distance from a specified address. Surveys of mode share: American Community Survey, National Household Travel Survey	
Examples of quantifiable performance goal: Increase pedestrian Level of Service criteria for a given street or area to LOS D by 2040 • Number of pedestrians on a given street • Ease and safety for street crossings • Condition of sidewalks • ADA compliance • Pedestrian Level of Service standards	• Criteria for pedestrian friendly streets: • Width of sidewalk • Amenities (shops, restaurants, sidewalk cafes) • Shade trees • Barriers between sidewalk and travel lanes
Implementation costs: • Sidewalk repair/ADA compliance $300–$500/sq. ft.	**Congestion impacts:** • Changing traffic signals to emphasize pedestrian safety could slightly impact motorist convenience.
Complementary Strategies: • Transit station improvements • Sidewalk improvements • Safe routes to school strategies • ADA compliance	• Transit oriented development • Traffic signal improvements • Transit service • Complete streets policies
Responsible agency(ies): Caltrans (state highways), counties, cities	
Primary stakeholders: • Caltrans • Counties • Cities • Public works • Engineering	• ITS (traffic signals) • Safe Routes to School coalitions • California Walks • American Association of Retired Persons

Sources: *US DOT Policy Statement Integrating Bicycling and Walking into Transportation Infrastructure*
Transportation Research Board Transportation Research Record 1538 2007

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Motor Vehicle Restriction Zones	
TDM: Motor vehicle restriction zones limit motor vehicles at a certain place, either temporarily or permanently. Most vehicle restrictions are implemented by local or regional governments, often as part of a downtown revitalization program or neighborhood traffic management plan, or during a period of exceptional traffic congestion or pollution. Cyclavia and Open Streets are examples of this, where major streets are closed down on the weekend for Active Transportation. Permanent examples include the 3rd Street Promenade in Santa Monica and Main St. in Riverside.	
Pros: • Enables other modes of transportation in the affected areas • Deferred vehicle trips (if temporary)	**Cons:** • Potential motorist and business opposition • When effective, can reduce traffic congestion, road and parking facility costs, crash risk, pollution emissions and local environment impacts
How measured: Use of alternate modes in corridor around vehicle restriction zone; change in LOS after permanent implementation	
Examples of quantifiable performance goal: Increase pedestrian usage on street by 10%	
Implementation costs: • Temporary – variable costs for set up, security and tear down • Permanent – cost of bollards/barriers	**Congestion impacts:** • Can temporarily increase congestion until confusion is resolved.
Complementary Strategies: • Bicycle racks • Pedestrian improvements	• Increased bike facilities to/from zone • Increased transit service to area
Responsible agency(ies): Local cities	
Primary stakeholders: • Local cities • Local businesses • Transit agencies	
Examples: Pedestrian malls (3rd Street Promenade, The Grove, Downtown Disney)	

Sources: *Examples of Ciclovia type events (Cyclavia, http://ciclavia.wordpress.com/about/)*
Ciclovia, Bogota, Columbia; http://streetswiki,wikispaces.com/Ciclovia; http://en.wikipedia.org/wiki/Cicolov%C3%ADa
Pedestrian Malls: Santa Monica Promenade; http://enwikipedia.org/wiki/Third_Street_Promenade
Riverside Main Street Pedestrian Mall; http://www.riversideca.gov/shop/retail-centers.asp

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Safe Routes to School Programs	
TDM: Parents dropping off children at school represents a significant level of morning local congestion (10–15%). Increasing the number of students walking or bicycling can reduce local congestion.	
Safe Routes to School: The use of resources to encourage children not to be driven to school, including bike/ped infrastructure improvements, education, encouragement and enforcement.	
Pros: • Reduced congestion during peak periods • Increased safety for students • Increased health/fitness	**Cons:** • Can require considerable involvement from parents, teachers and law enforcement for some programs
How measured: Change in congestion around schools; change in number of students walking or bicycling to school	
Examples of quantifiable performance goal: Increase the number of students biking or walking to school by 20% from 2012 to 2040 (age and distance appropriate). • Number of students biking or walking • Reduction in student fatalities/injuries • Reduction in accidents around school • Before/after studies with education programs	
Implementation costs: • Funded through Federal and State grants specific to Safe Routes to School	**Congestion impacts:** • Can reduce morning trip chaining, resulting in lower congestion.
Complementary Strategies: • Sidewalk improvements • Bicycle infrastructure and parking • ADA compliance	• Traffic signal upgrades • Traffic calming
Responsible agency(ies): Caltrans, cities, school districts	
Primary stakeholders: • Students • Law enforcement • City planning/engineering • School administration • Bicycle education organizations (CICLE, League of American Bicyclists)	• Parents • Teachers • Residents/businesses around school locations • Parent, Teachers Association (PTA)

Sources: *National Center for Safe Routes to School*
Caltrans Local Assistance: Safe Routes to School Program
Case Studies; http://katana.hsrc.unc.edu/cms/downloads/srts_case_studies.pdf

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Bicycle and Pedestrian Infrastructure Improvements	
Bicycle and Pedestrian Infrastructure Investments: Developing bicycle and pedestrian facilities to reduce motorized vehicle use for both short (<3 miles) all–purpose trips and medium (<5 miles) all–purpose trips.	
Pros: • Reduced congestion • Reduced emissions • Reduced capital expenditures • Improved public health	**Cons:** • May not be effective for longer commutes • Some roadways may require widening or innovative solutions to be effective
How measured: Bicycle Mode Share: Bicycle counts and surveys on a regular schedule. This can be done through manual counts, or through ITS technologies to automatically count bicyclists.	
Examples of quantifiable performance goal: Increase Bicycle and Walking Mode Share to 10% of all daily commutes by the year 2040; reduce bicycle and pedestrian fatalities by at least 50% by 2040. Miles of Active Transportation facilities as a percentage of roadway miles Reduction in bicyclist and pedestrian fatalities • Increase in number of bicyclists and pedestrians by gender over baseline year	
Implementation costs: • Bike lane $5,000–$50,000/mile • Bike path $600,000–$2+ million/mile • Signage $500–$2,000/mile	**Congestion impacts:** • Can result in lower speeds on some facilities, which could result in increased vehicular congestion during peak periods
Complementary Strategies: • Increased bicycle parking • Wayfinding signage • Safe Routes to School plans	• Sustainability strategies • Bicycle/Pedestrian transit integration
Responsible agency(ies): Caltrans, CTCs, cities	
Primary stakeholders: • Cities • Counties • Local bicycle advocates • MPOs	• State DOTs • Transit agencies • Rail organizations (for Rails to Trails) • Utility companies (power line corridors)

Sources: *US DOT Policy Statement Integrating Bicycling and Walking into Transportation Infrastructure*
Transportation Research Board Transportation Research Record 1538 2007
National Cooperative Highway Research Program (NCHRP) Report 552: Guidelines for Analysis of Investments in Bicycle Facilities

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Bicycle Transit Integration	
TDM: Bicycling, combined with transit, increases the effective range of transit users.	
Pros: • Increases first mile/last mile connectivity from .5 miles to 1–5 miles	**Cons:** • More effective for longer distances that normally wouldn't be traveled by bicycle alone
How measured: Average number of bicyclists on buses, trains, or routes/day, traveler O/D surveys.	
Implementation costs: • Bus racks ($500–$1,000 installed) • Dedicated spaces on rail ($500–$5,000 installed)	**Congestion impacts:** • Reduced vehicles on roadways, particularly during peak periods • Increased transit ridership
Complementary Strategies: • Folding Bikes on Transit program • Secured bicycle parking at employment centers • Bike lanes, paths and designated routes • Bicycle racks on buses	• Secure bicycle lockers at major transit stations • Dedicated, safe bicycle storage on light/heavy rail cars • Bike share • Bike stations
Responsible agency(ies): Transit agencies, Commuter Rail Agencies	
Primary stakeholders: • Transit agencies	

Sources: *Example, Portland Oregon; http://www.portlandonline.com/transportation/index.dfm?a=70399&c=36638*
http://www.trimet.org/howtoride/bikes/index.htm
Caltrain; http://www.transitunlimited.org/Caltrain_bicycle_access

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Alternative Work Schedules	
TDM: Alternative Work Schedules can reduce the number of vehicles during peak periods. Key strategies include flexible work schedules, staggered shifts, and compressed work weeks.	
Flextime: Employees are allowed some flexibility in their daily work schedules. For example, rather than all employees working 8:00 to 4:30, some might work 7:30 to 4:00, and others 9:00 to 5:30. Staggered shifts: Shifts are staggered to reduce the number of employees arriving and leaving a work site at one time. Some shifts may be 7:00 to 3:30, others 8:30 to 5:00, and others 10:00 to 6:30. Similar effect on traffic as flextime, but does not give individual employees as much control over their schedule.	Compressed workweek (CWW): Employees work fewer, but longer days; such as four 10–hour days each week (4/40) or 9–hour days with one day off every two weeks (9/80).
Pros: • Decrease peak period VMT • Improved travel time for participants	**Cons:** • Minor employer costs to manage • May not work universally
How measured: Number of participants, as collected by AQMD or local government through reporting or surveying; American Community Survey, National Household Travel Survey.	
Examples of quantifiable performance goal: Increase percentage of participants among eligible employers by 2040 % Participation from base year to current year by type of schedule	
Implementation costs: • Telecommuting • Commute trip reduction programs	**Congestion impacts:** • Reduced peak period VMT • Improved travel time for participants
Complementary Strategies: • Increased bicycle parking • Wayfinding signage • Safe Routes to School plans	• Sustainability strategies • Bicycle/Pedestrian transit integration
Responsible agency(ies): Employers	
Primary stakeholders: • Employers • TMOs (where applicable)	

Sources: *US Office of Personnel Management – Handbook on Alternative Work Schedules; http://www2.opm.gov/flsa/oca/aws/INDEX.asp*
Victoria Transportation Policy Institute, TDM Encyclopedia – Alternative Work Schedules; http://www.vtpi,org/tdm/tdm15.htm

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Telecommuting	
TDM: Telecommuting is where an employee uses telecommunication from home, rather than a central office, for any number of days in the week.	
Pros: • Reduced VMT during peak periods • Reduced VMT overall	**Cons:** • Only effective for certain industry types, such as white collar
How measured: Number of participants, as collected by AQMD or local government through reporting or surveying.	
Examples of quantifiable performance goal: Increase percentage of participants among eligible employers by 2040. Number of pedestrians on a given street; Criteria for pedestrian friendly streets; Ease and safety for street crossings – Width of side	
Implementation costs: • Initial costs, such as remote computer • Second and succeeding year costs tend to decline	**Congestion impacts:** • Reduced vehicles on roadways, particularly during peak periods
Complementary Strategies: • Congestion pricing • Increased parking fees	• Satellite offices
Responsible agency(ies): Employers	
Primary stakeholders: • Employers	

Sources: Transportation Policy Institute, TDM Encyclopedia Telecommuting; http: www.vtpi.org/tdm/tdm43.htm

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Guaranteed Ride Home Program	
TDM: The Guaranteed Ride Home Program is a complementary service that provides employees who carpool, vanpool, or take transit a guaranteed free ride home in the event of a family emergency or other situation where the employee must leave before his or her shift ends.	
Pros: • Increases desirability of carpooling, vanpooling and transit	**Cons:** • Has potential to be costly without employer set limits
How measured: Complementary Strategy Use measurements for transit, carpooling, and vanpooling strategies	
Examples of quantifiable performance goal: N/A, see Carpool, Vanpool, or Transit subsidy tools **Covered Emergencies:** • Personal illness • Illness, death of family member • Unscheduled overtime (carpool/vanpool only)	**Not Covered:** • Personal errands • Scheduled medical appointments • Scheduled overtime • Natural disasters where the entire workforce is dismissed
Implementation costs: • Variable incident related costs	**Congestion impacts:** • Assists other programs to reduce congestion
Complementary Strategies: • Transit subsidies • Carpool incentives	• Vanpool incentives
Responsible agency(ies): Employers	
Primary stakeholders: • Employers • Employee	• Taxi service

Sources: Case Study – Houston Texas; http://www.ridemetro.org/services/Bus/GuaranteedRide.aspx

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Congestion Pricing	
TSM: Congestion Pricing is the charging of fees for a vehicle to access certain high congestion areas, either during peak periods or other periods.	
Pros: • Reduces congestion • Pricing revenue can be used to fund transportation improvements in local area	**Cons:** • Implementation costs high • Political opposition
How measured: AADT on facility and adjacent facilities	
Examples of quantifiable performance goal: Reduce AADT on key streets by 10%	
Implementation costs: • ITS infrastructure to monitor, charge fees, and enforce violations	**Congestion impacts:** • Targeted reduced congestion, such as in London
Complementary Strategies: • Increased transit service • Free local shuttle/Dash service	• Car free streets • Bike share
Responsible agency(ies): Cities	
Primary stakeholders: • City ITS department • City police	• Transit agencies

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – High Occupancy Vehicle (HOV) Lanes	
TSM: HOV Lanes provide an incentive to carpool/vanpool/transit by reducing travel times for those allowed in the lanes during congested periods.	
An HOV lane is a dedicated lane(s) along a freeway or arterial dedicated to vehicles with more than one or two occupants. They increase corridor capacity and provide an incentive for SOV drivers to rideshare. On average, a HOV lane in Los Angeles County accommodates 1,300 vehicles or 3,300 people per hour during peak periods, and the county HOV system serves approximately 331,000 vehicle trips or 780,000 person trips per day.	
Pros: • Reduces SOVs on roadways during peak periods • Reduces air pollution and GHGs • Reduces travel time	**Cons:** • Expensive to construct • Can create congestion at access points
How measured: Average Vehicle Occupancy (AVO): ADT in carpool lanes	
Examples of quantifiable performance goal: Measured by AVO; increase carpooling by 20% over 2012 by the year 2040. AVO <1.5 (example)	
Implementation costs: • Capital costs • Right–Of–Way costs	**Congestion impacts:** • Can significantly reduce congestion
Complementary Strategies: • Carpool subsidies • Ride matching services • Guaranteed Ride Home program • Carpool matching software • Preferential parking • Parking cash out	• Carpool/bus lanes on arterials • Carpool exemption for ramp meters • Toll road exemptions for carpools • Trip reduction ordinances • Congestion pricing/parking pricing strategies • Park and ride facilities
Responsible agency(ies): State Department of Transportation, county transportation commissions, MPOs, cities	
Primary stakeholders: • Caltrans • MPOs • CTCs • Cities	**Secondary stakeholders:** • Law enforcement (HOV lane violations) • Traffic news media • Carpooling/ridesharing organizations

Sources: Caltrans District 7, "2008 HOV Annual Report – Executive Summary," January 2009

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Traffic Incident Management	
TSM: Incidents (crashes, special events, weather, and other causes) represent over 20 percent of all congestion. Reducing the response and clearance times can reduce overall congestion.	
Traffic Incident Management: The systematic use of resources to reduce the duration and impacts of accidents, special events, severe weather, and other causes, and to improve the safety of motorists, crash victims, and first responders.	
Pros: • Improved safety (reduced secondary accidents, responder safety) • Reduced emissions • Emergency preparation • Reduced capital expenditures	**Cons:** • Measuring the effectiveness of the program over time will require high–level support and buy–in from leadership within participating agencies • Quest for improving time should not come at expense of safety
How measured: Roadway clearance time: The time between first recordable awareness of an incident (detection/notification/verification) by a responsible agency and first confirmation that all lanes are available for free traffic flow. Incident clearance time: The time between the first recordable awareness and the time at which the last responder has left the scene.	
Examples of quantifiable performance goal: Reduction in incident duration for each incident evaluation period (by type of accident) • <1/2 hr (20% reduction); 1 hr & <2 hrs (10% reduction) • >1/2 & <1 hr (15% reduction); >2 hrs (10% reduction)	
Implementation costs: • Cost of positioning tow trucks and other material • Administrative costs of reporting	**Congestion impacts:** • While not reducing VMT, can reduce congestion
Complementary Strategies: • Transportation management centers • Regional 5–1–1 system	• Changeable message sign
Responsible agency(ies): Caltrans, county transportation authorities, cities	
Primary stakeholders: • Law enforcement • Fire and rescue emergency medical services • Transportation agencies • Towing and recovery • Emergency managers	• Hazardous materials responders • Medical examiners and/or coroners • Elected and appointment officials • Traffic media • Highway users

Sources: http://www.ops.fhwa.dot.gov/publications/fhwahop 10010/presentation.htm
Traffic Incident Management Handbook; http://ntl.bts.gov/lib/ipodocs/rept_mis/13286.pdf

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Ramp Metering	
TSM: Ramp Metering reduces freeway congestion by limiting the rate at which vehicles enter the freeway.	
Pros: • Reduces the number of vehicles entering the freeway at one time, metering the flow on to the freeway facility and reducing congestion.	**Cons:** • Creates localized surface street congestion for benefit of reduced travel time for longer distances.
How measured: Average travel delay, average freeway speed	
Examples of quantifiable performance goal: • Increase average freeway speeds	• Reduce average travel delay
Implementation costs: • Can be significant depending on level of sophistication	**Congestion impacts:** • Reduced vehicles on roadways, particularly during peak periods • Increased transit ridership
Complementary Strategies: • Ramp meter bypass lanes for carpools	
Responsible agency(ies): Caltrans, CTCs, MPOs, cities	
Primary stakeholders: • Caltrans • CTCs • Traffic management centers	

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Traveler Information Systems	
TSM: Traveler Information Systems	
By providing current and accurate information to travelers, Traveler Information Systems provide real–time speed and incident information to enable options for trip routing.	
Pros: • Can promote alternate modes of transportation • By avoiding congested areas, motorists can help mitigate the local congestion	**Cons:** • Can be expensive to develop/maintain • Requires coordination between technologies across jurisdictions
How measured: Number of times 5–1–1 is accessed on daily basis or during peak hours	
Examples of quantifiable performance goal: Increase the number of users of 5–1–1 system by 20% through 2040.	
Implementation costs:	**Congestion impacts:** • Can reduce congestion, but difficult to quantify benefits, when benefits are seen through other TDM or mode split strategies
Complementary Strategies: • Sigalert.com • 5–1–1 system • Google maps (traffic)	• Traffic management centers • Changeable message signs • Next bus service
Responsible agency(ies): State Department of Transportation, county transportation commissions, MPOs, cities	
Primary stakeholders: • County ITS coordinator • California Highway Patrol • Local police force	• Freeway patrols • Caltrans

TABLE 6 CMP Toolbox and Strategies Continued

CMP Toolbox – Signal Synchronization	
TSM:	
By synchronizing traffic signals on arterials, the capacity of facilities can be increased.	
Pros: • Reduces vehicle idling time at intersections • Increases LOS as traditionally measured	**Cons:** • Can be expensive to develop/maintain • Can require communication/coordination between technologies across jurisdictions
How measured: AADT, delay, average travel time	
Examples of quantifiable performance goal: Reduce average travel time by 15%.	
Implementation costs: • Implementation costs are higher than unsynchronized signals	**Congestion impacts:** • Can reduce congestion, but difficult to quantify benefits, when benefits are seen through other TDM or mode split strategies
Complementary Strategies: • Sigalert.com • 5–1–1 system • Bus preemption signal for signals • Google maps (traffic)	• Traffic management centers • Changeable message signs • Next bus service
Responsible agency(ies): Counties, cities	
Primary stakeholders: • Local police force • Caltrans	

NOTES

[1] FHWA, CMP: A Guidebook, April 2011

[2] Association of American Railroads, https://www.aar.org/policy/positive–train–control

[3] Center for Advanced Automotive Technology, http://autocaat.org/Technologies/Automated_and_Connected_Vehicles/

[4] City of New York, http://www.nyc.gov/html/dot/downloads/pdf/2014–09–03–bicycle–path–data–analysis.pdf

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APPENDIX

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