CALIFORNIA DEPARTMENT OF TRANSPORTATION

2008
RAMP METERING ANNUAL REPORT

District 07
Los Angeles and Ventura Counties

Connector Metering

Ramp Metering

STATE OF CALIFORNIA
Governor Arnold Schwarzenegger

BUSINESS, TRANSPORTATION AND HOUSING AGENCY
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OFFICE OF FREEWAY OPERATIONS
Ramp Metering Branch

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RAMP METERING ANNUAL REPORT

DEPARTMENT OF TRANSPORTATION
DISTRICT 07

Los Angeles and Ventura Counties

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2008 RAMP METERING ANNUAL REPORT
District 07

The 2008 Ramp Metering Annual Report has been prepared by the Office of Freeway Operations Ramp Metering Branch in District 07. The information in this report encompasses all of the work performed by the Ramp Metering Branch on the on-ramp and connector meters in Los Angeles and Ventura Counties.

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I. EXECUTIVE SUMMARY

Caltrans District 07 Ramp Metering Annual Report highlights the major tasks performed and documents the accomplishments achieved in Los Angeles and Ventura Counties by the Ramp Metering Branch during the 2008 calendar year.

Some of the tasks performed by the Ramp Metering Branch include:

- Operation and functionality inspection of 2041 ramp metering systems
- 314 trouble ticket issues reported to ITS and/or Electrical Maintenance
- 174 ATMS modifications
- 232 RAM Pages (ramp meter programs) modifications
- 268 projects reviews
- 229 ramp metering inquiries received
- 100 public complaints and/or inquiries responded

In addition to the above tasks, the Ramp Metering Branch was also involved in the Interstate Route 210 Strategic Growth Plan – Congestion Relief Project, which was initiated by Governor Arnold Schwarzenegger. Route 210 was identified as the "test bed" for implementing Ramp Metering and Connector Metering in conjunction with the application of System Wide Adaptive Ramp Metering (SWARM) software algorithm to improve the existing traffic congestion without a major construction project.

The remaining responsibilities of the Ramp Metering Branch were to:

- Conduct manual traffic engineering data collections,
- Perform traffic engineering analyses at various ramps and connectors,
- Perform traffic engineering analyses to convert various existing ramp HOV bypass lanes to metered HOV or mix flow lanes,
- Review Capital Outlay Support (COS) and permit projects, and
- Review and update the Ramp Metering Development Plan (RMDP).

Ramp Metering Branch works with District 07 Intelligent Transportation System (ITS) Branch in testing new vehicle detection technologies to be installed at new ramp meter locations.

District 07 Ramp Metering Branch plays a very important role in the preparation, update and outline of the Traffic Operations Management Information System (TOMIS). TOMIS is a data reporting system that captures work expenditures for Traffic Operations Program activities. It enables production of a monthly report comparing workload output (production) to work effort (expenditure). It is administered by Caltrans headquarters and is supported by all districts throughout the state.

II. DISTRICT 07 SYSTEM MANAGEMENT VISION

District 07 is committed to using numerous traffic management strategies to maintain an efficient freeway system by keeping it operating at, or at least near, capacity. Ramp Metering is an integral part of the system management concept that focuses on implementing operational strategies to reduce congestion and increase safety on California's state highway system with the help of advanced technologies.

LARTMC, Glendale

The Advanced Transportation Management System (ATMS), located in the new Los Angeles Regional Transportation Management Center (LARTMC), has been an important tool for the ramp metering operation. ATMS provides both historical and real-time traffic data for on-ramps, off-ramps, freeway-to-freeway connectors, and freeway mainline. Such data constitutes a vital and often is the primary source in determining the appropriate metering rates that are unique to each and every ramp meter location. In addition, District 07 ramp-metering engineers, using the ATMS display map and field video cameras, can quickly and effectively modify numerous ramp meter parameters including, but not limited to, time of metering operation and metering rates in the LARTMC. This feature is often used when responding to a scheduled construction project, a major traffic incident, or an emergency lane closure due to an unforeseen event. Thus, the use of ATMS in District 07 results in an increase in traffic flow efficiency by allowing faster response to dynamic field conditions. Furthermore, the Media and various agencies currently use the ATMS real-time traffic data and display map to report traffic conditions via Radio, Television, and the Internet.

District 07 continues to develop adaptive ramp metering strategies to improve traffic management. The continual research and development of the SWARM is being tested on the 210 Freeway, which is part of the Route 210 Strategic Growth Plan – Congestion Relief Project. This innovative metering technology promises to improve the efficiency of our metering system by operating various ramp meters through a corridor in an integrated manner. This approach is consistent with the Department's shift toward integrated corridor management, which is mandated through the Corridor Management Improvement Account. The Corridor Management Improvement Account is the centerpiece of the infrastructure bonds, which were approved by voters in 2006 as Proposition 1B. Proposition 1B is an obligation bond to fund the state for safety improvements and repairs to state highways, upgrades freeways to reduce congestion, repairs local streets and roads, upgrades highways along major transportation corridors, improves seismic safety of local bridges, expands public transit, helps complete the state's network of car pool lanes, reduces air pollution, and improves anti-terrorism security at shipping ports by providing for a bond issue not to exceed nineteen billion nine hundred twenty-five million dollars ($19,925,000,000). SWARM, and other adaptive metering strategies, will continue to be researched, evaluated, tested, and implemented, as we move forward in 2009 and beyond.

III. DISTRICT 07 RAMP METERING HISTORY

In 1965, the Freeway Operations Department, as it was called, was created in District 07 to locate, analyze and solve operational deficiencies on the existing freeway system. The first experimentation with ramp metering in District 07 occurred on the Labor Day weekend in the midst of 1960's on the Southbound Route 14 to the Southbound Route 5 Freeway connector. The connector was manually metered with temporary signals to prevent the Southbound Route 5 freeway from breaking down. The metering operation was a complete, instant success.

On April 11, 1967, the District's first two permanent fixed-time ramp meters were installed on the northbound Hollywood Freeway (Route 101) at Sunset Boulevard and Hollywood Boulevard. The project was successful in relieving congestion on the freeway mainline without seriously affecting surface street operations. Freeway delay was reduced by about 75%.

In the early 1970's, District 07 created the Los Angeles Area Freeway Surveillance and Control Project (LAAFSCP). The Harbor Freeway (Route 110), Santa Monica Freeway (Route 10) and the San Diego Freeway (Route 405) highlighted this experimental project, known as the 42-mile loop. The system had two objectives. The first objective was to test and evaluate various techniques for improving movement of people and goods on the freeway system by reducing traffic delay and increasing traffic safety. The second objective was to integrate those techniques that can show a great promise into an effective traffic management system.

The LAAFSCP consisted of a vast network of traffic sensors, telemetry equipment, and a computer workstation. The computer workstation was merely a map display and an operator's console. 24-hour real-time traffic data, including freeway mainline volumes, speeds, occupancies, ramp volumes, travel time and traffic delay, was the outcome. From this humble beginning, the current high tech LARTMC has evolved to be on the right track for success. District 07 is vigorously and continually working to further improve the system.

Traffic responsive ramp metering was also tested in the LAAFSCP project. The traffic responsive logic showed a great improvement over the existing fixed-time traffic controllers.

Also in the early 1970's, District 07 had developed a "Program to Upgrade and Control the Los Angeles Freeway Network". This program monitored sections of freeways that needed to be widened due to very heavy traffic demand. It was noted that as projects were completed, freeway congestion disappeared. However, as time went on, congestion returned since many motorists that were formerly taking city streets discovered the faster-moving freeways. Ramp meters were then installed to control the tremendous inflow of traffic into the freeway system and to discourage local short trips.

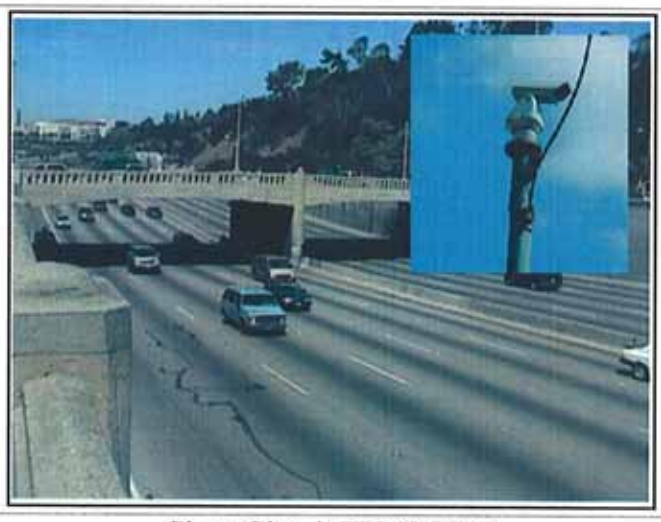
In 1992, the first connector meter in District 07 was installed on the Southbound Route 5 connector to the Southbound Route 110 Freeway. In 1994, Route 105 (Glenn Anderson

Freeway) was opened to traffic. Design and construction of the Route 105 included on-ramp meters and freeway-to-freeway connector meters. Implementation of connector metering was possible on Route 105, due to long and wide connectors providing adequate storage and sufficient sight distance for fast approaching vehicles, especially on heavy volume connectors. Route 105 has a total of 19 connector meters in District 07, 17 are currently in operation, and the other 2 were turned off due to a lack of heavy traffic demand and consistent free flow conditions on the receiving freeway (downstream from these connector meters).

Today, ramp metering represents an important element of the Traffic Management System (TMS). The focal point of TMS is maximizing traffic flow on the freeway system by reducing congestion. Other elements of TMS include:

- Freeway Surveillance Equipment – Provides essential traffic data to the LARTMC for early detection of incidents and locates areas of traffic congestion. Freeway surveillance equipment is part of the ramp meter detection system and is installed and maintained by the Ramp Metering Branch, the ITS (Intelligent Transportation Systems) Branch and the Electrical Maintenance Branch.

- Closed Circuit Television (CCTV) – Cameras with pan, tilt and zoom capabilities are used to confirm the exact location, nature and severity of freeway incidents.



Close Circuit TV (CCTV)

- Changeable Message Signs (CMS) – The LARTMC manages 114 signs in District 07, located at strategic points on the freeway system. The LARTMC updates the display of CMS messages to provide major incident information affecting traffic conditions and severe weather advisories. Estimated travel times are now displayed on selected CMSs district wide. In the event of child abduction, CMSs are used by law enforcement to display Amber Alert messages.

- Highway Advisory Radio (HAR) – A short-range broadcast radio with transmitters located within the freeway right-of-way to provide motorists with updated informational messages such as directional advisories, traffic control restrictions as well as general information. HAR messages are remotely activated from the LARTMC.

- Freeway Service Patrol (FSP) – A team of 152 tow trucks patrolling 474 miles of Los Angeles County freeways to provide help to stranded motorists and quickly repair or remove disabled vehicles to relieve freeway congestion. Typical hours of operation are Monday through Friday between 6:00 AM and 7:00 PM, Saturday and Sunday from 10:00 AM until 6:30 PM.

IV. RAMP METERING BASICS

Ramp Meter Signal Heads

Ramp meters are traffic signals placed on freeway entrance ramps or freeway connectors to control the flow of vehicles entering the freeway or moving from one freeway to another. They are designed to decrease congestion and improve the average speed of vehicles traveling on the freeway, by controlling vehicular flow at most inputs onto the mainline. By installing a traffic signal at the on-ramp, Caltrans can control the rate at which vehicles enter the freeway. Vehicles entering at short intervals are less likely to slow down flowing traffic and can merge onto the freeway without causing the traditional bottlenecks, associated with heavy on-ramp traffic volumes. In addition, metering has been proven to reduce rear end and sideswipe traffic collisions, especially during congestion periods.

The capacity of a freeway, in free-flow conditions, could easily reach 2000 vehicles per hour per lane (v/h/l). However, during congestion periods, this number often drops below 1500 v/h/l. Thus, a free-flowing traffic lane can carry 33% more cars than a congested lane. It is in the public interest to maintain the freeways moving at near capacity; therefore, by dispersing vehicular platoons entering the mainline, ramp metering helps to decrease traffic delays.

Ramp Meter Controller

Vehicles with two or more occupants may use the High Occupancy Vehicle (HOV) by-pass lane (where available) to access the freeway mainline without stopping at the ramp meter. This practice promotes carpooling that reduces the overall number of vehicles on the freeway. On the other hand, since the freeway traffic demand continues to rise, the need to meter the carpool by-pass lane is anticipated. Currently, District 07 is evaluating the possibility of metering the existing HOV by-pass lanes.

Additionally, ramp meters are used to discourage short distance travelers from using the freeway, especially, during the congestion periods where many parallel arterial streets can be utilized. Thus, the option to use local arterials might be better than waiting at ramp meters. As a result, mainline traffic congestion will improve due to less freeway demand.

The following documents were prepared by Caltrans as a guide in implementing ramp metering policy throughout the State:

- Deputy Directive DD-35 defines Caltrans' policy on Ramp Metering. See Attachment 3.
- Ramp Metering Policy Procedures, dated August 1997, provides guidelines for implementing the Department's Ramp Metering Policy (DD-35). See Attachment 4.
- Design of Ramp Metering Facilities is governed by the "Ramp Meter Design Guidelines". Refer to REFERENCES, Item No. 1.

RAMP METERING BENEFITS

The effectiveness of ramp meter systems has always been called into question. It is difficult to quantify ramp metering benefits, without conducting a detailed study to compare with and without effects of ramp metering implementation.

In 2000, Minnesota Legislature passed a bill that required the Minnesota Department of Transportation (MnDOT) to study ramp metering effects in their state. Thus, MnDOT, responsible for managing freeway access in the Twin Cities (Minneapolis and St. Paul) metropolitan area, conducted a four-month study aimed towards capturing these benefits.
Data was collected during two different time periods; ramp meters were turned on in the first period then turned off in the second. After analyzing the data from both periods, it was concluded that ramp metering was a cost-effective investment. The study revealed the following ramp metering benefits:

- 21% reduction in accidents
- 8% increase in speed
- 22% reduction in travel time
- 16.3% increase in throughput capacity

For detailed information, please refer to REFERENCES, Item No. 11.

TYPES OF RAMP METERING

There are three types of ramp meter operations in District 07:

1. Type 1 – Fixed Time/Time of Day (TOD)
2. Type 2 – Local Mainline Responsive (LMR)
3. Type 3 – System Wide Adaptive Ramp Metering (SWARM)

It should be noted that all three types of metering operation could be implemented according to the following two modes:

- One Car per Cycle Metering - One vehicle per cycle per lane is permitted to enter the freeway. Assuming that green time is typically 2 seconds, the remaining cycle is red time,

varying from 2 to 18 seconds. In District 07, the typical maximum metering cycle (Red + Green) time does not exceed 10 seconds or 360 vehicles per hour per lane (v/h/l), in order to minimize meter violations and to minimize vehicle back-up onto local city streets.

- Platoon Metering - Two to three vehicles per cycle per lane are permitted to enter the freeway. Theoretically, it is possible to meter up to 1,200 v/h/l for two vehicles per cycle and 1,320 v/h/l for three vehicles per cycle. Typically, platoon metering is used at freeway connectors or high-traffic ramps, where traffic volumes exceed 900 v/h/l. However when feasible, widening is the better option.

Type 1 - Fixed Time/Time of Day (TOD) Metering

Fixed time ramp metering is the simplest form of ramp metering that disperses platoons of vehicles entering the freeway. The ramp meter is programmed to operate based on a single or multiple fixed metering rates, for a pre-set metering period, based on historically averaged traffic conditions. Thus, the primary drawback of this metering type is that the cycle length is "fixed" and does not change or respond to real-time freeway mainline traffic conditions. In addition, if the on-ramp gets congested, vehicle backup (Queue) reaches near city street, the Queue loop, usually located at the entrance of the ramp, will be triggered and the meter rate will increase to the maximum rate of 15 vehicles/minute/lane until traffic back-up at the ramp is relieved. Metering rates can vary from 180 to 900 v/h/l for single-vehicle metering and 600 to 1320 v/h/l for platoon metering. This practice allows more vehicles to enter the freeway mainline regardless of what the freeway traffic conditions are. Therefore, this type of ramp metering is used only on a limited basis when mainline loops are malfunctioning or during construction.

Type 2 - Local Mainline Responsive (LMR) Metering

In addition to all the features of fixed time metering, local mainline traffic-responsive metering is directly influenced by the dynamic traffic conditions at the on-ramp and on the freeway mainline adjacent to the on-ramp. If the traffic volume and occupancy on the mainline freeway drop below a set critical volume and critical occupancy, the ramp meter software would override the programmed meter rates to allow more vehicles to enter onto the freeway; thus relieving traffic congestion on local streets. Local mainline responsive metering is widely used in District 07.

The primary drawback of this type of local mainline responsive metering operation is that it reacts only to local mainline traffic conditions immediately adjacent to the ramp and does not take into account the conditions of the rest of the freeway corridor. Thus, the need to improve the Local Mainline Responsive Metering had brought the concept of System Wide Adaptive Ramp Metering (SWARM).

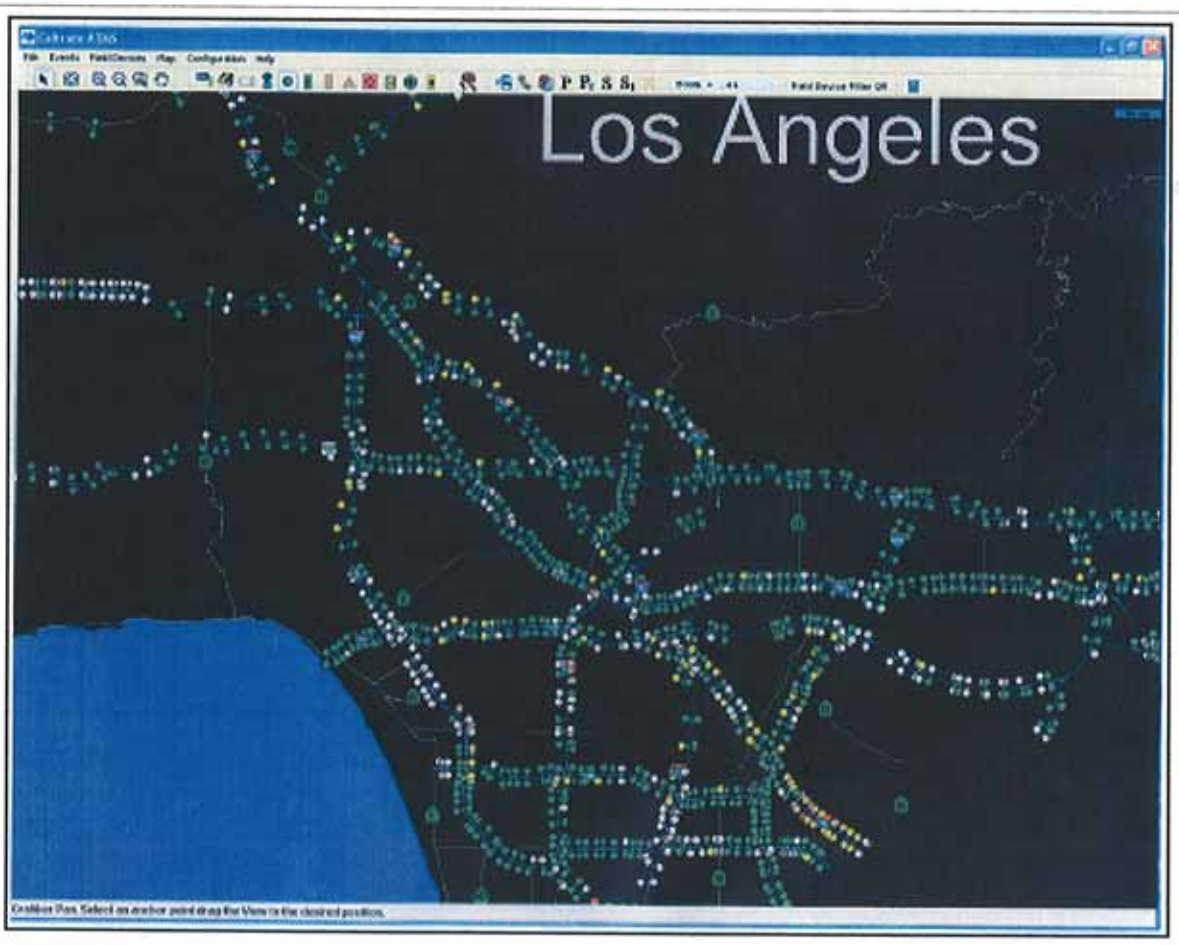
Type 3 - System Wide Adaptive Ramp Metering (SWARM)

System Wide Adaptive Ramp Metering (SWARM) seeks to optimize traffic flow on the mainline by being responsive to a whole freeway corridor. For additional information, please refer to the "SYSTEM WIDE ADAPTIVE RAMP METERING" section of this report.

V. RAMP METERING TECHNOLOGY

ADVANCED TRANSPORTATION MANAGEMENT SYSTEM (ATMS)

The Advanced Transportation Management System (ATMS), located in the new Los Angeles Regional Transportation Management Center (LARTMC), is a computer system that was designed to assist in the collection and dissemination of traffic information in order to effectively manage the existing District 07 Transportation System. Refer to REFERENCES, Items No. 6, 7, and 14 for more detail. The LARTMC was designed with the intention to reduce congestion and increase safety through the rapid detection of, response to, and removal of incidents on the freeway. Using ATMS, Ramp Metering engineers manage recurring congestion by remotely controlling the ramp meter operation and analyzing freeway system efficiency.



ATMS

Another additional ATMS enhanced feature includes incident detection, which is integrated with the closed circuit television (CCTV) cameras to view dynamic traffic conditions, and changeable message signs (CMS) and highway advisory radio (HAR) to inform motorists of existing freeway conditions and estimated travel times.

ATMS gets its data from field hardware. The vehicle loop detector system, located on freeway mainlines, on-ramps, off-ramps, connectors, etc., is connected to traffic controllers enabling data to be sent to the ATMS.

Ramp Metering, Intelligent Transportation Systems (ITS) and Electrical Maintenance personnel are responsible for new installations as well as maintaining, operating, and upgrading or modifying existing field elements.

Freeway Communications System

In October 2006, Caltrans District 07 Ramp Metering Branch and ITS Branch entered into a contract with Delcan Technologies to modify the existing ATMS software. The goal of the modification was to improve the ATMS to be more user-friendly and to be able to easily deploy the SWARM algorithm.

SYSTEM WIDE ADAPTIVE RAMP METERING (SWARM)

System Wide Adaptive Ramp Metering (SWARM) is a ramp meter operating system, developed by National Engineering Technology (NET) Corporation (Currently known as DELCAN TECHNOLOGIES), based on the recommendations and input of District 07 Ramp Metering Branch.

SWARM seeks to optimize traffic flow on the mainline by being responsive to actual and future forecasted traffic conditions throughout the system and to recurrent and non-recurrent congestion.

Types of SWARM

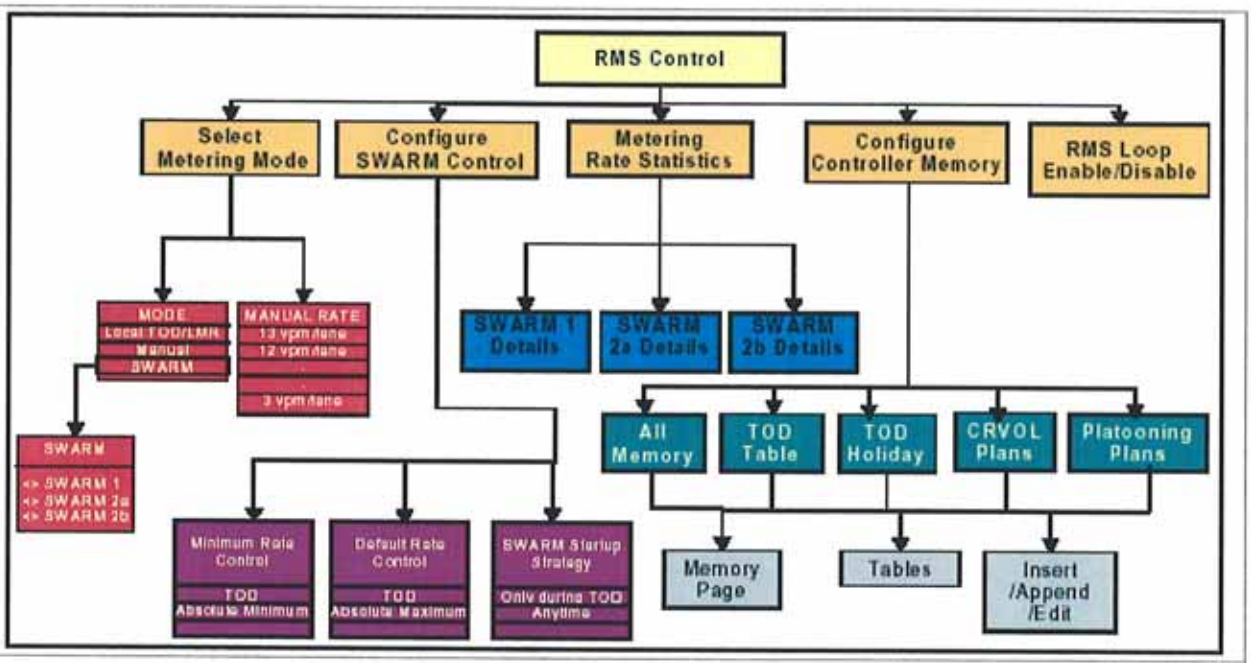
There are three basic types of SWARM: SWARM 1 operates system wide to predict congestion, SWARM 2a and SWARM 2b operate locally and are based on headway and storage capacity respectively.

SWARM 1

SWARM 1 is system wide adaptive and based on a freeway network divided into SWARM sections. Each section begins and ends at a mainline vehicle detection station (VDS)

identified as a bottleneck. SWARM 1 algorithm operates at designated and dynamic bottleneck locations and controls vehicle flow of all upstream on-ramp locations linked to that bottleneck.

Since it is directly related to congestion, density is monitored at each bottleneck location. The algorithm requires a nominal saturation density threshold for each mainline VDS in the network.



Ramp Meter Station (RMS) Control Diagram

The algorithm attempts to estimate the density *n* minutes (user settable) in the future based on real time traffic data. When estimated density, at the bottleneck, exceeds saturation density, ramp meter rates will be computed in an attempt to proactively react to the predicted onset of congestion. Starting at the bottleneck and working upstream, the software calculates new metering rates based on the required volume reductions. Actual metering rates vary between maximum and minimum rates. Since rate adjustments may be positive or negative, excess or reduction values are propagated upstream (user settable).

SWARM 2a

SWARM 2a is local responsive based on headway (time between consecutive vehicles). It uses the density function to compute local metering rates and attempts to maintain headway such that the maximum flow can be obtained.

SWARM 2b

SWARM 2b is local responsive based on storage. It computes the number of vehicles stored between two VDS stations and compares it to a maximum storage value. Metering rates are computed to maintain level of service (LOS) D as long as possible.

SWARM Combinations

SWARM can be used in combinations, i.e., SWARM 1 and 2b. The controller uses the more restrictive rates of those recommended. Within a bottleneck segment, some controllers can be programmed to be on local Time of Day (TOD) mode while others are programmed to be on one of the SWARM modes. The use of the local Time of Day mode is especially useful at on-ramps that are experiencing heavy traffic volumes and cannot be further restricted.

Advantages of SWARM

- It predicts future traffic conditions.
- It maximizes traffic flow on the mainline.
- It is responsive to actual traffic conditions throughout the freeway corridor.
- It is responsive to recurring and non-recurring congestion.

Disadvantages of SWARM

- Ramp control and traffic surveillance devices must be connected to a computerized communications center.
- Communication lines have to be maintained at all times in order for SWARM to operate properly.
- SWARM requires accurate data from mainline and on and off-ramp detectors in order to work effectively.
- It is more complicated than local traffic responsive metering.

SWARM Testing

SWARM was originally tested in 2001 and 2002 on Routes 210 and 405. Results of the Route 210 study were published in the "PRELIMINARY SWARM STUDY REPORT" dated November 2001 and the "SWARM STUDY FINAL REPORT" dated October 2002. A brief summary was prepared following the Route 405 study in 2002. Please refer to REFERENCES, Item Nos. 4, 5 and 16. SWARM is being tested on Route 210. SWARM is being tested on both Eastbound and Westbound Route 210, from Baseline Road. at the Los Angeles / San Bernardino County line (PM 52.00) to Marengo Avenue in the City of Pasadena just east of the Route 134 Interchange (PM 26.00). This current SWARM testing is the first since the Route 405 study in January 2002. Data of the testing will be compiled and analyzed as part of the Route 210 Growth Plan – Congestion Relief Project.

SATMS 3.0

SATMS (Semi-Automatic Traffic Management System) 3.0 is a new computer processor chip developed recently by the Caltrans ITS Branch to upgrade the existing ramp metering software.

The previous versions were SATMS 1, used only at on-ramps, and SATMS C, used for both connector and on-ramp locations.

The primary goal of the SATMS 3.0 upgrade is to improve the compatibility with the new ramp metering SWARM algorithm. Furthermore, other features were also added in order to enhance the overall ramp meter operation.

In 2002, the SATMS 3.0 chip was tested at several locations in District 07. Once the testing phase was successfully completed, the updated chip was installed at all on-ramp controller cabinets. By the end of 2003, ramp meter operation was universal district wide as the SATMS 3.0 chip replaced the obsolete model.

The new features in the SATMS 3.0 chip are:

- The controller 170 initiation reset time following a power failure to reduce the watchdog black out problem is sped up. Thus, variation or brief interruption in power voltage level will have less effect on the operation of the ramp meter.

- The loss of communication Cycle Time is increased from one cycle (approximately 30 seconds) to ten cycles (around five minutes) in order to minimize frequent changes between SWARM and local Time of Day modes. Thus, communication losses lasting no more than ten cycles would not affect the implementation of SWARM in the field; the controller would meter for up to five minutes, according to the last SWARM rate before communication failure occurred.

- The Queue override maximum rate can be set by a ramp meter engineer to be lower than 15 vehicles per minute per lane. In addition, the new chip provides the ability of linking the activation of the Queue override mode to mainline traffic condition by setting a threshold speed level (normally 35 mph) to control Queue activation.

- The Queue override mode, created to speed up the metering rate when vehicular back up reaches the entrance of the on-ramp, can be used with the SWARM mode. If activated, the Queue override mode will gradually increase the metering rate, dictated by SWARM, up to the maximum rate of 15 vehicles per minute per lane; thus, reducing the overflow of vehicles onto city streets.

- Whenever metering is initiated or terminated by SWARM or loss of communication cycle time exceeds ten cycles, the controller will apply one-minute "Green" light at the beginning and at the end of each metering phase.

- Set default values for the SATMS 3.0 chip are improved over the older versions.

- The traffic responsive feature is improved.

- Q2 loop operation (for connectors only) is enhanced as follows:

1. Q2 can be programmed to operate independently of Q1 to trigger "Green" light when backup occurs.
2. Similarly to on-ramps, the Queue 1 Override maximum rate can be set at a rate lower than 15 vehicles per minute per lane. In addition, the Queue 1 and 2 activation modes can be controlled by mainline threshold speed level set by the engineer.

Continually and currently, Ramp Metering Branch and ITS Branch are jointly improving the SATMS 3.0 microchip. These expected improvements may include:

- Normalizing the real-time occupancy reading by averaging the last two occupancy readings.
- Smoothing off the gradual increase in the Traffic Responsive Rate according to a settable integral. This feature will delay the rest in the "Green" mode and greatly reduce any unnecessary occurrences.
- Linking the watchdog safety switch to address "0F4" so it can be detected by ATMS.
- Testing of the new SATMS microchip started in spring 2008.
- Requesting to making modifications to rest meters in the 'dark mode' for energy conservation.

UNIVERSAL RAMP METERING SYSTEM (URMS)

Several ramp metering software packages are being used by different districts within Caltrans. They include the San Diego Ramp Metering System (SDRMS), which was deployed in Districts 3, 6, 8, 10, and 11, the Semi-Automatic Traffic Management System (SATMS), which was deployed in District 07, and the Traffic Operations System (TOS), which was deployed in District 4. District 8 has just deployed Revision 8 of the SDRMS. District 11 is in the process of testing a dynamic ramp metering system. A variation of SATMS, named Orange County Ramp Metering System (OCRMS), was deployed in District 12 to allow staggered ramp metering.

While the ramp metering algorithms implemented in these other software packages react to rather than to prevent bottlenecks, SWARM may have the capability of preventing bottleneck activation, instead of just reacting to it, by integrating traffic predictive capabilities into the metering logic.

Caltrans strives to unify the ramp metering operating software systems to minimize the operations and maintenance costs. A software package, called Universal Ramp Metering System (URMS), was therefore developed and is currently being evaluated statewide. URMS is deemed the future of ramp metering operations software.

VI. ROLES AND RESPONSIBILITIES

Ramp Metering Branch, Intelligent Transportation System (ITS), and Electrical Maintenance Branch work as a team in respect to ramp metering. Ramp Metering Branch is responsible for the operation of ramp meters district-wide. ITS Branch provides technical support for the LARTMC. Electrical Maintenance Branch is responsible for the maintenance of hardware and electrical equipment. To maintain and to improve the cooperation, these groups meet on a quarterly basis.

RAMP METERING BRANCH

The ramp metering system in the District is inspected and regularly observed through routine field surveillance and frequent ATMS observation. Ramp Metering Engineers are responsible for the ramp meter programmed software as well as the proper operation of ramp meters district-wide. Ramp Metering operation software consists of a "RAM (Random Access Memory) Map" package which includes a program sheet, Time of Day (TOD) table and a detailed loop detector (sensor) diagram layout, in addition to an electrical as-built plan showing all of the hardware. Ramp Meter hardware includes signals, controllers, loop detectors, signing, striping and advance warning devices. Area Engineers (lead workers) are assigned ramp meters by routes or segments of routes. Other engineers within the Ramp Metering Branch assist the Area Engineers. For more details, please refer to ATTACHMENT 3 and Ramp Metering Branch Production Section on page 12.

ELECTRICAL MAINTENANCE BRANCH

Electrical Maintenance responds to ramp meter malfunctions reported by CHP, Ramp Metering Branch, ITS Branch and the general public, if related to hardware and electrical problems. As a routine procedure, Electrical Maintenance performs a 120-day check of all ramp metering equipment. The following main actions are performed by the Electrical Maintenance technician during this check:

- Maintenance of Freeway Meter Signals

Meter signals should be checked for damage, proper operation, and timing every 120 days. This check should include the following items as a minimum:

(A) Field Inspection

(1) Visual check of indications.
(2) Signal indication alignment.
(3) Hardware (hand-hole covers, signs, poles, backplates, etc.).
(4) Pull box covers (broken, missing, and clear of dirt or debris).
(5) Visual check of service cabinet and equipment locks.

(6) Visual check of loops in roadway (if possible).

(B) Cabinet Interior

(1) Controller unit indicator lights and display.
(2) Function and timing.
(3) Detector indicator lights and operation.
(4) Check output devices, including interconnect systems.
(5) Thermostat and ventilation system including filter.
(6) Clean cabinet and interior components.
(7) Check documentation (timing sheets, schematics, wiring plans, etc, and inspection noted on cabinet login card).

(C) Cabinet Exterior

(1) Condition of surface (paint, damage, graffiti).
(2) Condition of locks and handles.
(3) Operation of Police panel switches.

- Meter Timing and Operation

Initial timing of ramp meter signals and any subsequent changes in timing are the sole responsibility of the Ramp Metering Branch.

Maintaining the meters is the responsibility of the Division of Maintenance or the district Electrical Maintenance Branch.

INTELLIGENT TRANSPORATION SYSTEMS (ITS) BRANCH

ITS Branch provides technical support for the LARTMC. This includes ramp metering and ATMS. ITS's main duties are:

1. Test and develop new software related to metering operation.
2. Set up the configuration of ATMS.
3. Review electrical design plans for new projects.
4. Monitor and correct any discrepancies found on the ATMS data reports such as icons, loop configuration, etc.
5. Check system electrical operation and final compliance in accordance to the contract documents or as-built plans on all new and replacement equipment.
6. Test and maintain communication lines between field equipment and LARTMC.

VII. RAMP METERING BRANCH PRODUCTION

Ramp Metering Branch production was divided into work categories as follows:

1. Surveillance and Monitoring of Ramp Metering Operation.
   Charts describing Ramp Metering production:
   A. Operation and Inspection of Ramp Metering Cabinets (Figure 1)
   B. Issues Reported to ITS or Electrical Maintenance (Figure 2)
   C. Ramp Meter Traffic Data Collections (Figure 3)
   D. Modify Ramp Metering Software Programs (Figure 4)
   E. Ramp Metering Projects Reviewed (Figure 5)
   F. Complaints & Inquiries (Figure 6)
2. Route 210 Strategic Growth Plan – Congestion Relief Project
3. Ramp Meter Data Collections
   A. Various Routes
   B. Route 210, Congestion Relief Project
4. Capital Project Review
5. Permit Project Review
6. Metered Ramp Data Summary
7. Ramp Meter Development Plan (RMDP)
8. Testing of new Vehicle Detection Technologies
9. Convert existing ramp HOV bypass lane to a metered HOV or mix flow lane.
10. SWARM Testing and Implementation
11. Major Ramp Metering Operational study
12. New Ramp Meters

The following sections summarize in depth the amount of work performed for each of these categories. All data included in the sections below was obtained from Weekly Ramp Meter Reports filed by all Ramp Metering Engineers.

1. Surveillance and Monitoring of Ramp Metering Operation

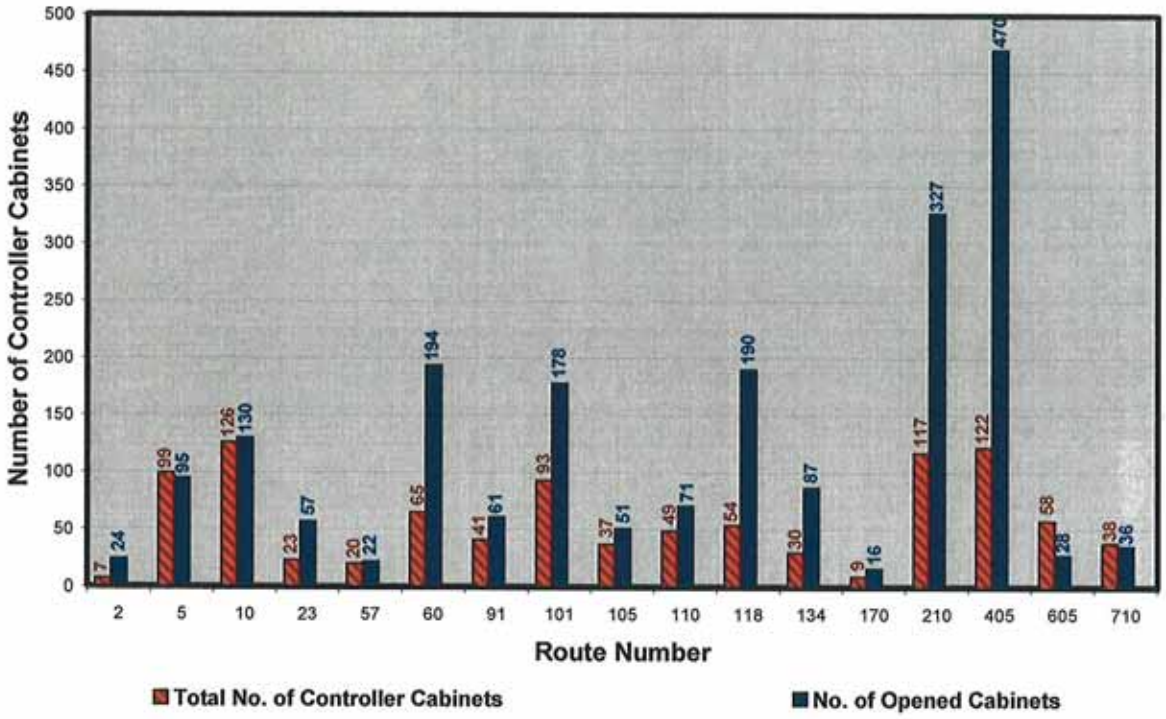
Currently, District 07 has 900 metered on-ramps and 23 freeway to freeway connectors, making it the largest ramp metering district in Caltrans. The Ramp Metering Branch periodically performs field surveillance and corrects minor software and hardware problems associated with the metering operation. Staff observed traffic backups on the ramp, verify appropriate metering rates and check for any malfunctions with signal lights or advanced warning signs. If the meter is off during metering hours, the controller software program and cabinet hardware will be checked in order to diagnose the problem; minor issues will be corrected, while major problems are reported to Electrical Maintenance or ITS Branch for repairs.

During the course of 2008, the Ramp Metering Branch inspected ramp-meter controller cabinets 2041 times. The reason for checking these controller cabinets varied from simply verifying the

operations of the ramp meter to performing corrections or updates to the programmed software, and in some cases, resetting or replacing cabinet hardware. This may involve reopening the ramp meter controller cabinets numerous times to solve occurring problems.

Figure 1

A- Operation and Inspection of Ramp Metering Cabinets

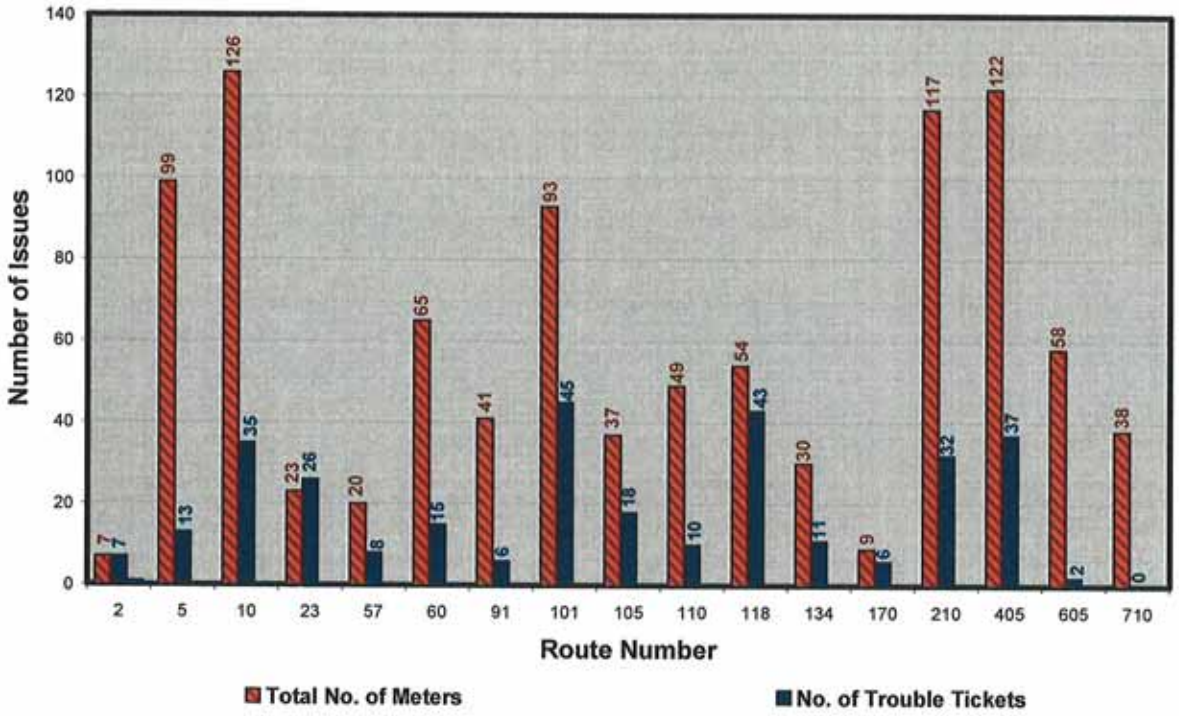


Note: Some of these ramp-meter controller cabinets have been inspected more than once during the year.

In 2008, a total of 2041 ramp-meter controller cabinets were inspected.

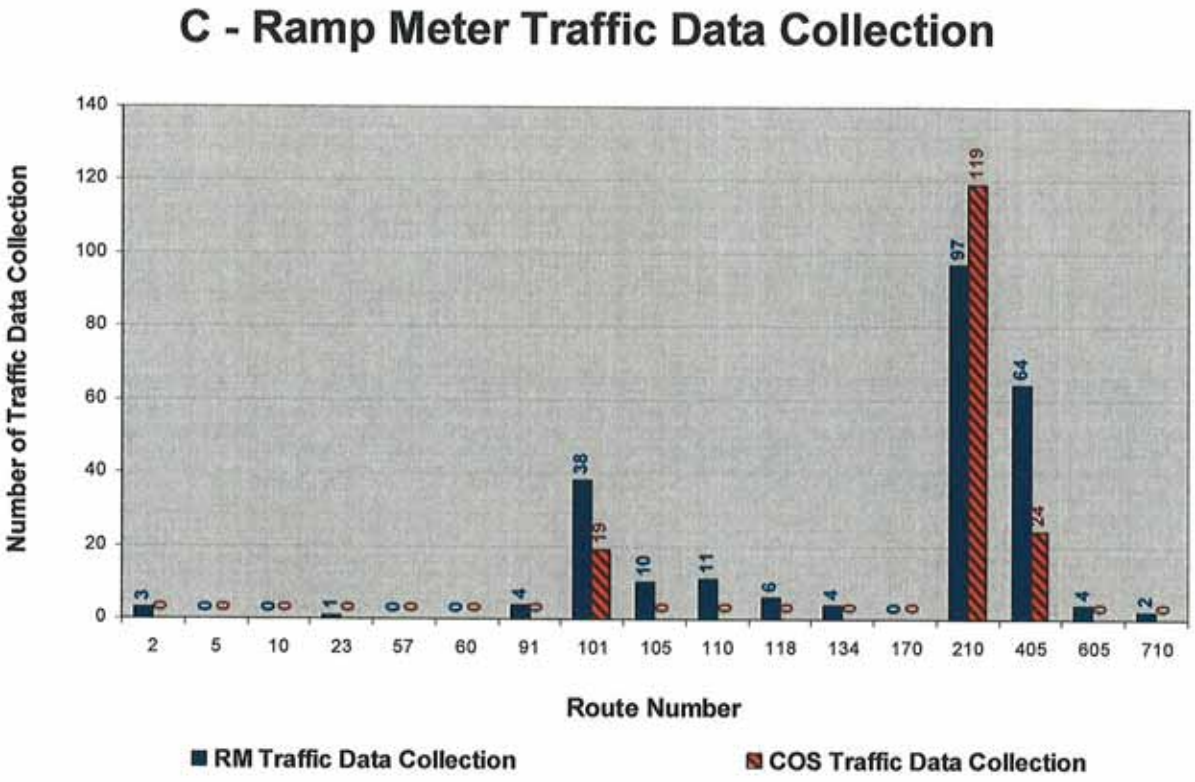
Figure 2

B- Issues Reported to ITS or Electrical Maintenance



In 2008, a total of 314 ramp-metering problems were reported.

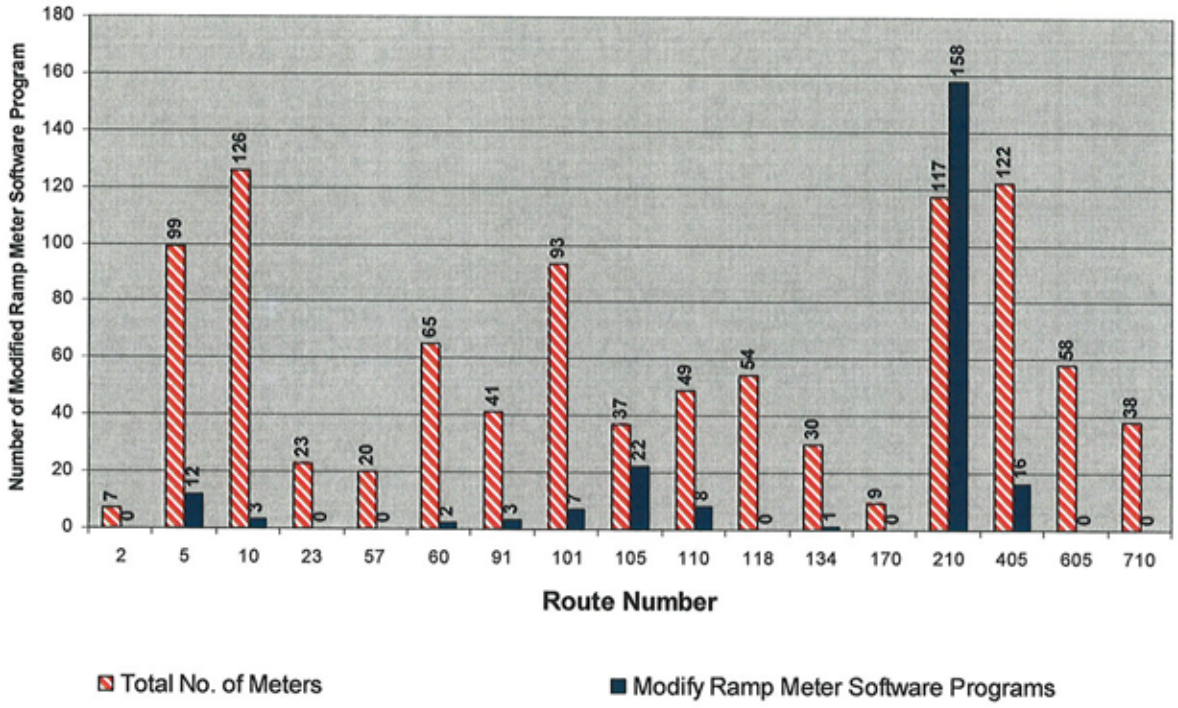
Figure 3



The Ramp Metering Branch performed a total of 406 traffic data collection in 2008: 244 routine ramp metering traffic data collections and 162 traffic data collections for COS projects.

Figure 4

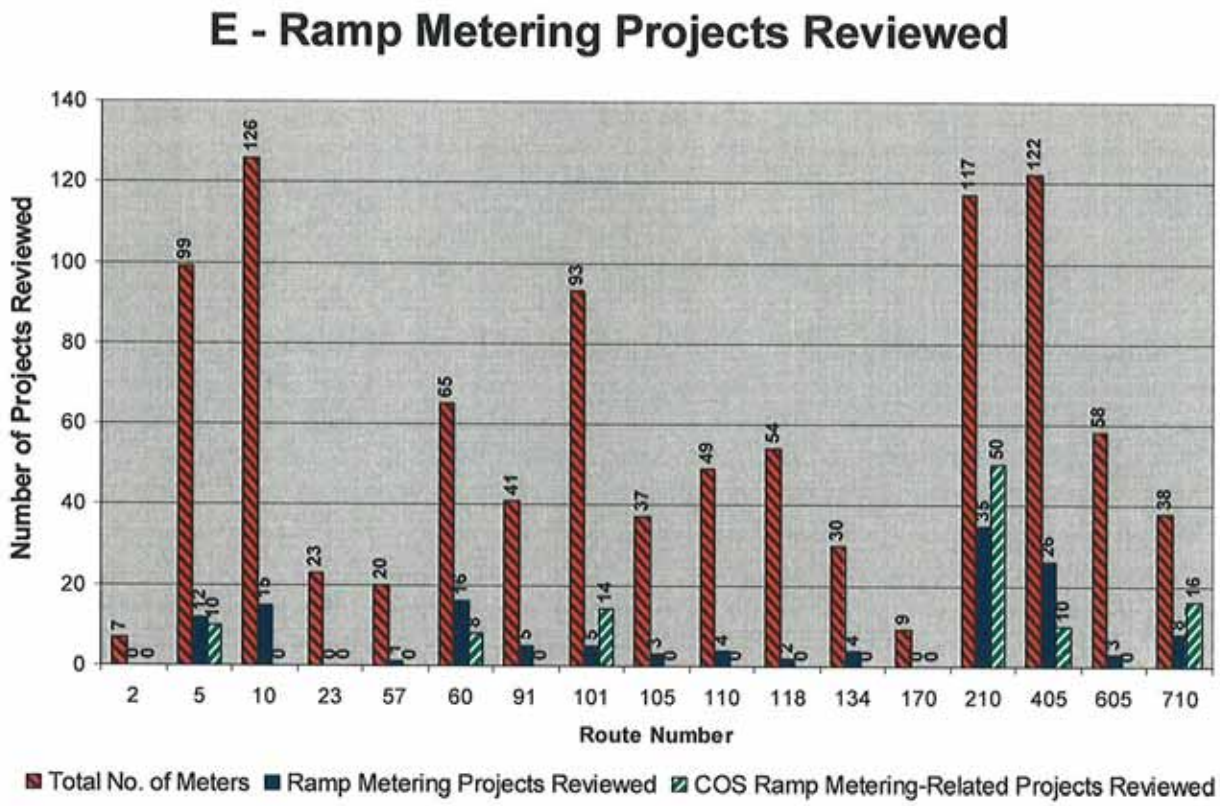
D - Modify Ramp Meter Software Programs



The Ramp Metering Branch modified 232 ramp meter software files in 2008. Ramp meter software programs, also known as RAM (Random Access Memory) Map, contain numerical values programmed into the SATMS 3.0 software to properly operate the ramp meters.

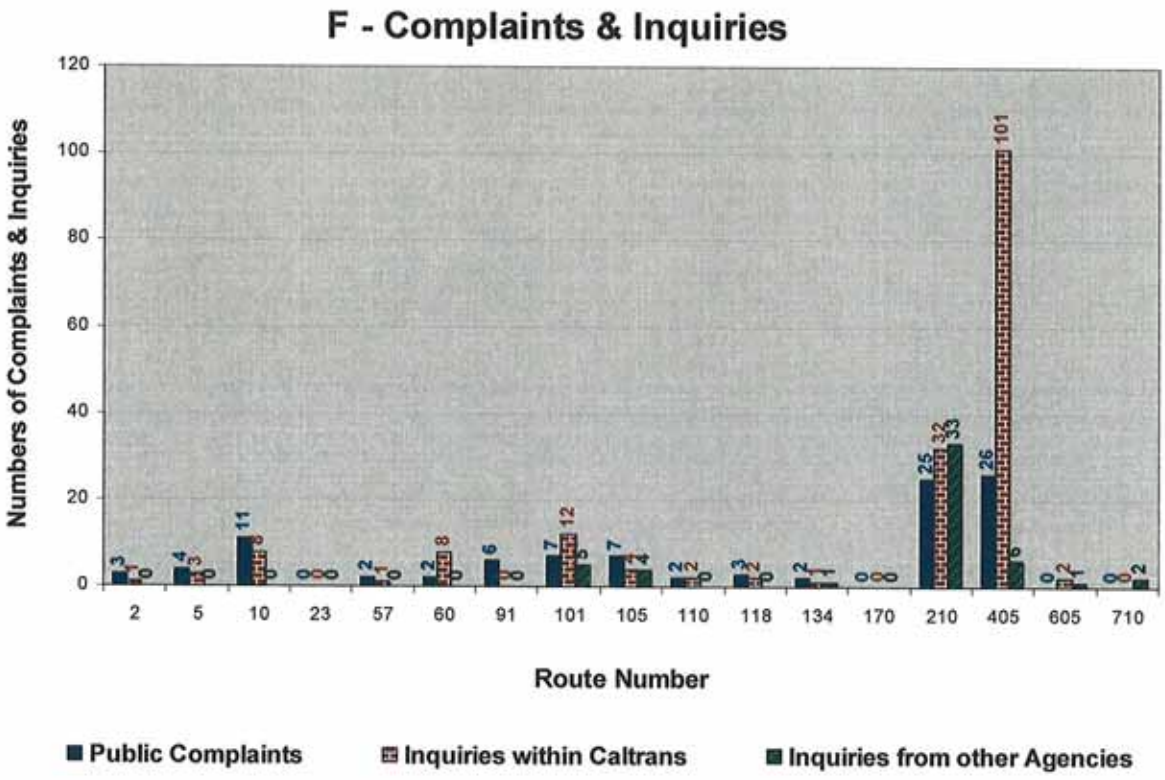
Note: During 2008, the Ramp Metering Branch resources were mainly committed to Route 210 to implement the Congestion Relief Projects mandated by Governor Arnold Schwarzenegger.

Figure 5



The Ramp Metering Branch reviewed 268 projects in different stages of design and construction in 2008. This includes 158 ramp metering projects and 110 COS projects; and may include reviewing the same projects at 35%, 65%, 95% and 100% submittals.

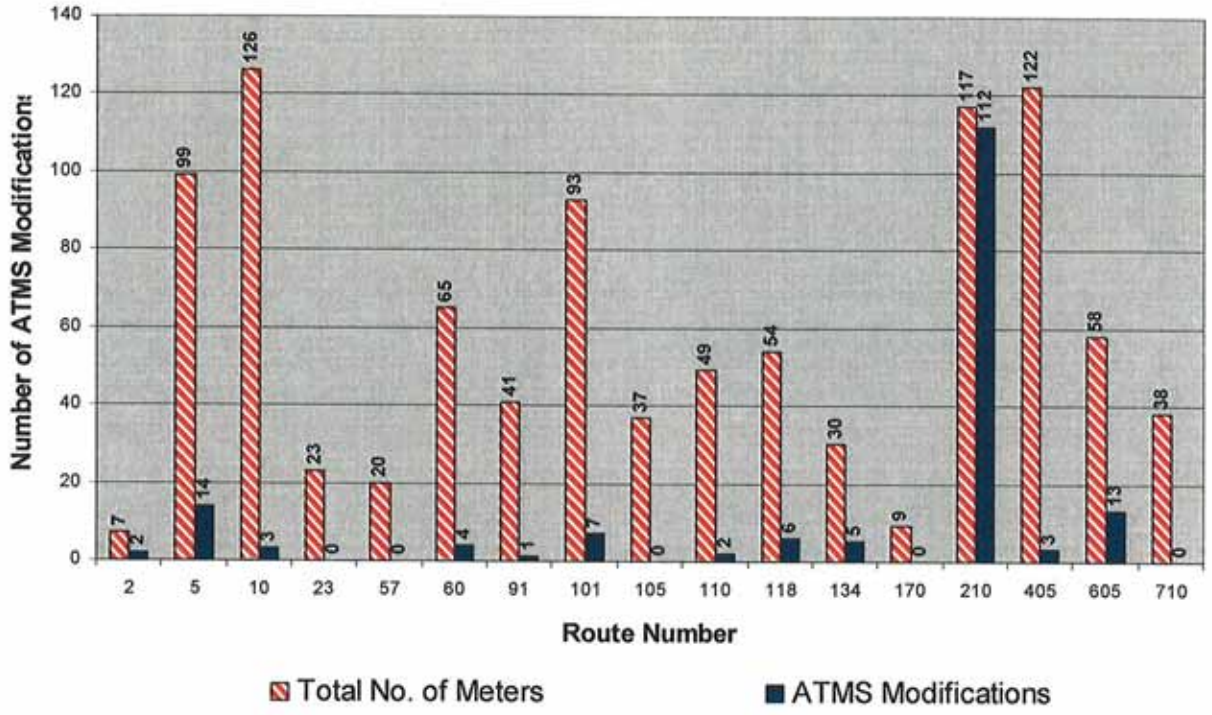
Figure 6



The Ramp Metering Branch provided traffic data, which may include manual queue and demand data collections; ATMS generated reports, and as-built plans, to various District 07 Offices, Public Agencies, and the general public. In 2008, the Ramp Metering Branch received 229 inquiries. In addition, the Ramp Metering Branch recorded and responded to 100 public complaints in 2008.

Figure 7

G - ATMS Modifications



The Ramp Metering Branch monitored ramp meters both by performing field surveillance and by using the ATMS. ATMS allows engineers to monitor and modify ramp-metering data remotely from the LARTMC. In 2008, the Ramp Metering Branch performed 174 ATMS modifications.

2. *Route 210 Strategic Growth Plan – Congestion Relief Project*

Introduction

Route 210 Congestion Relief Projects primarily focused on the development and implementation of enhanced on-ramp and freeway-to-freeway connector metering strategies designed to improve the ability for effective traffic management along Route 210 corridor.

Needs and Challenges

Continued population growth and economic development in the 210 Corridor communities has resulted in increasing travel demand on the freeway. In addition, extension of the freeway in recent years to connect with Routes 15 and 215 to the east has also created additional demand for travel on the freeway. Meanwhile, the built out urban environment surrounding the freeway, combined with difficult geography and other environmental, political and funding constraints, have often made it impractical to add physical capacity to the roadway within the corridor at a pace equal to the increasing demand. The result of this imbalance between available capacity and demand has been increased congestion resulting in slower travel speeds, extended delay and increased exposure to accident risk, in addition to declining environmental quality. As an illustration of this increasing congestion, performance metrics suggested that average peak period travel speeds have decreased by an estimated 30 percent between the years 2000 and 2006 for some sample sections of the corridor.

Project Description

Route 210 Strategic Growth Plan consists of 2 congestion relief projects. The first project, EA 257404, extends over the eastern segment of Route 210 corridor from post mile 26.00 (City of Pasadena) to post mile 52.00 (San Bernardino County Line), while the second, EA 258004, covers the western segment from post mile 0.31 (Route 5) to post mile 24.92 (Route 134).

The deployment and testing of these strategies should provide the opportunity to evaluate the potential impacts of different aspects of the improvements. These main aspects are highlighted below:

1. The installation of 41 new traffic responsive ramp meters at existing non-metered on-ramp locations, bringing the total to 107 ramp metering stations throughout the corridor.

2. Addition of 24 microwave vehicle detection stations, along brief remote sections in the western end of Route 210 corridor: This new technology was installed within a rural section along the western segment of the corridor.

3. Installation of 9 freeway-to-freeway connector meters along five major interchanges (Routes 2, 57, 118, 134 and 605 with Route 210 corridor): The purpose of this strategy is to regulate the flow of vehicles, from connecting freeways, onto Route 210.

4. Introducing High Occupancy Vehicle (HOV) bypass lane metering at 9 existing and 20 new ramp metering locations. This strategy is intended to better manage the previously uncontrolled flow of HOV vehicles onto the Freeway mainline.

5. Conversion of 23 existing non-metered HOV by-pass lane to metered on-ramp mix flow lanes: This conversion was required in order to provide additional vehicular storage capacity needed to effectively implement ramp metering operation.

6. System Wide Adaptive Ramp Metering (SWARM): This advanced metering strategy works by evaluating real-time traffic situations at dynamic bottlenecks throughout the corridor, in order to predict future congestion and properly set upstream ramp metering rates helping to reduce congestion. This methodology improves the ability to maximize and maintain efficiency of traffic flow throughout the corridor. It represents an innovation over current metering capabilities, by implementing ramp metering on a system wide basis, thus, responding to both recurring and non-recurring traffic congestion.

The addition of these strategies also required many supporting implementations including the addition of signage (both extinguishable and static), re-striping, the addition or repositioning of traffic detectors, and ramp reconfiguration.

Analysis of Existing Condition in 2006, prior to the improvements:

Analysis of existing condition was conducted in 2006, prior to the start of construction which took place throughout the course of 2008, and it consisted of:

1. March 2006 to June 2006: Manual field data collections at all 107 on-ramp locations, located within the two project limits. In addition, ATMS mainline data for volume, occupancy and speed was collected on the same days that the manual field data collections were conducted.
2. October 2006 to December 2006: Travel time runs in both directions of Route 66, paralleling the eastern segment of Route 210.
3. November 2006 to December 2006: SWARM implementation on both directions of the eastern segment of Route 210. In addition, travel time runs were conducted at all four connectors leading to Route 210 from Routes 57 and 605.

Project Activities in 2008:

Construction of the two Congestion Relief Projects along Route 210 corridor was undergoing throughout the course of 2008. The Ramp Metering Branch involvement for most of the year consisted of providing technical support and field review of critical construction activities including the preparation of numerous *Contract Change Orders* (CCO) needed to modify some elements in the original project design plans.

3. *RAMP METER TRAFFIC DATA COLLECTION*

There are three types of traffic data collections conducted by the Ramp Metering Branch:

1. Queue and Demand (Q & D) traffic data collection
2. High Occupancy Vehicle (HOV) traffic data collection
3. Violation Rates traffic data collection

"Queue and Demand" traffic data collection are performed to study the operation of metered ramps, which include time and extent of traffic backup (Queue) due to ramp metering. In addition to measuring the peak and total traffic demand at the ramp, the types of vehicles using the ramp are also recorded.

Queue and Demand information helps to implement an effective ramp metering strategy. Metering rates are implemented according to type and volume of traffic demand at the on-ramp in relation to mainline traffic conditions.

"HOV" traffic data collection is conducted at metered on-ramps with an HOV lane. The purpose of this data collection is to determine time intervals, types of vehicles (truck, buses, and motorcycles), peak and total HOV traffic demand, vehicle occupancy (2, 3 ...persons per vehicle). The percentage of usage of the HOV lane, in relation to the metered mix-flow lane, is calculated with this information. In addition, the number of HOV lane violations is recorded. If the violation rate is determined to be high, this information is forwarded to the California Highway Patrol for enforcement.

These three types of traffic data collection should be conducted, on a yearly basis at all active ramp meter locations. However, due to time constraints and limited resource allocations, these traffic data collection activities are currently performed as a result of public complaints, upcoming projects and developments impacting the operation of the ramp meter. See Figure 3 for detail. Thus, if a public complaint related to excessive back-up on the ramp is received, a field review and a "Q and D" data collection might be conducted to properly investigate the problem and adjust the metering rate if needed. In addition, if a project to construct a new ramp or modify an existing one is being proposed, then a traffic data collection will be conducted, in order to assist in the new design. On-ramp traffic data collections might also be conducted during major studies (SWARM testing) or large-scale projects such as the Route 5 Widening and HOV project.

A. Various Routes

During the 2008 calendar year, the Ramp Metering Branch had conducted 406 traffic data collection along various routes.

B. Route 210 Congestion Relief Project

Manual Queue and Demand, and HOV traffic data collection activities were performed on the entire stretch of Route 210 between 4/25/2006 and 06/06/2006.

Data collection was conducted at all 107 on-ramp locations, located within the two project limits.

4. *Capital Project Review*

The Ramp Metering Branch reviews numerous projects and gets involved in ramp meter related issues, during the following stages of a project (see Figure 5):

1. PID (Project Initiation Document)
2. PSR (Project Study Report)
3. PR (Project Report)
4. All stages of PS&E (Plans, Specifications and Estimate)

In addition, the Ramp Metering engineers also keep track of the project's progress throughout the construction stage.

5. *Permit Project Review*

The Ramp Metering engineers review and comment on ramp meter related issues involved in permit projects, and oversight projects, which are usually prepared by consultants on behalf of local cities, counties or other agencies.

6. *Metered Ramp Data Summary*

The Ramp Metering personnel collect information for the METERED RAMP DATA SUMMARY. Information gathered includes but is not limited to the following items:

- Ramp type and configuration
- Number of lanes
- Ramp storage length
- "Meter On" signs
- HOV
- Metering hours
- Metering rates
- Inventory of loops & loop detectors
- Signing
- Striping
- Maintenance Vehicle Pullout (MVP) locations

The above information is useful for the following purposes:

- To provide a database for the "RAMP METER DEVELOPMENT PLAN" report.
- To generate a master list detailing all deficiencies and to forward it to the ITS group for repairs.

- To replace on-ramp detector loops, vehicle detector cards and to reconfigure detector loop connections (DLC), when needed, at numerous traffic controller cabinets.

7. *Ramp Meter Development Plan (RMDP)*

The first 10-year RMDP report was completed in 1997 and was due to be updated by 2008. However, an updated RMDP report was initiated in 2004 and published in July of 2005. This 10-year report contained an inventory of all on-ramps (metered and non-metered), metered connectors, in addition to a listing of on-ramps proposed or funded to be metered, within the next 10 years. The last RMDP was completed in 2008. For detailed information, please refer to REFERENCES, Item No. 2.

8. *Ramp Metering Procedure Manual and Addendum*

The 2005 Ramp Metering Procedure Manual and Addendum can currently be found at http://www.dot.ca.gov/dist07/news/reports/docs/RAMP%20METERING%20PROCEDURE%20MANUAL%20ADDENDUM.pdf.

9. *Installation of New Vehicle Detection Technologies*

During 2008, the Ramp Metering Branch installed new Microwave Radar Detection Technology at various locations on Interstate Route 5, Interstate Route 10 and Interstate Route 210 to detect vehicles on the freeway system. This radar system is easy to install and is compatible with the URMS software package that is being introduced at this time. Unlike the loop system and instead of closing freeway lanes, the radar system can be mounted on an existing power pole or an overhead sign pole with a minimal lane closure in place. The radar system detects traffic in the same manner as the loop detection does. The only difference is that the radar system detects traffic from overhead while the loop system is embedded in the roadway. The only draw back for this system is maintaining and positioning the radar to detect traffic properly while resisting the wind load without shifting or sliding from its position. Severe weather conditions or simply a traffic collision on the freeway can disrupt the functionality of this system.

Caltrans ITS Branch also experimented with wireless detection system. The wireless system works as the loop detection system as well. It is also embedded in the pavement – one device per lane. Unlike the loop system, the wireless detection system does not require wire to be run across the freeway lanes. Instead, each wireless system is embedded in a predrilled hole in each lane of the freeway. The only drawback is the battery life for each wireless detector can only last for maximum of 10 years. In addition, these wireless devices require individual programming to a separate control card located in the ramp metering cabinet. Maintaining such units may potentially be costly and time consuming.

10. Convert Existing Ramp HOV Bypass Lane to a Metered HOV OR Mix Flow Lane

In 2008, the Ramp Metering Branch conducted traffic study at Interstate Route 405 Southbound @ Manchester Avenue on-ramp. As a result of this study, it was decided to convert the existing ramp HOV bypass lane into a metered lane. This mitigation improved the traffic congestion at the interchange and added more storage capacity at the On-Ramp.

11. Major Ramp Metering Operational Studies

Widening and adding HOV construction projects on Interstate Route 405 from Interstate Route 105 to State Route 90 and from Wilshire Blvd to Route 101 were recently completed. Four ramp meters were modified and affected by the construction. Traffic Operational study was conducted in order to activate, evaluate and determine the appropriate metering rate. Queue and Demand (Q & D) and occupancy traffic data collections were performed on weekdays and weekends at the following locations:

- **NB & SB Route 23 from Route 118 to Route 101** – Install ramp metering equipment, components and communication lines for all ramps within this route. Studies will be performed to turn on these meters.
- **Route 118 in Ventura County from LA County Line to Route 23** – A fiber optic project, along with the widening of the State Route 118 from Tapo Canyon Road to Kuehner Drive, on the eastbound direction has been completed. Some ramps were modified within the project limits. Studies will be performed to turn on these meters.
- **Sepulveda Pass Project @ LA-405-NB** - This is the widening for northbound HOV Lane design-build project on Interstate Route 405 from Interstate Route 10 until Route 101. Ramp Metering Branch has contributed extensive assistance in the Project Risk Management and preparation of the Technical Provisions.

12. New Ramp Meters

On October 12, 2008 a fiery crash accident occurred just north of State Route 14 in the southbound Interstate Route 5 involved several trucks and took 3 lives. As a result of this tragic accident a committee was assigned to investigate the cause of this accident and come up with the recommendation in order to improve safety. One of the measures on the final recommendation was to meter all the on-ramps from State Route 126 to Interstate Route 5 in the southbound direction of Interstate Route 5 (Golden State Freeway). The proposed metering was in the following southbound on-ramps:

1- Rye Canyon Road
2- Magic Mountain Parkway
3- WB Valencia Boulevard
4- EB Valencia Boulevard
5- WB Mc Bean Parkway
6- EB Mc Bean Parkway
7- WB Lyons Avenue

8- EB Lyons Avenue / Pico Canyon
9- Calgrove Blvd

Five out of eight remaining on-ramps had controllers and basic hardware; they only needed meter head and minor hardware. There was no ramp metering hardware at the eastbound and westbound Mc Bean Parkway on-ramps and at the eastbound Lyons / Pico on-ramp. The three remaining locations were functional. Due to urgency of the project, it was decided that instead of cutting new loop detectors in the mainline lanes, Microwave Detector system was used in lieu of the loop detectors at these locations. By December 2008, all the above meters were activated.

13. Traffic Operations Management Information System (TOMIS)

Traffic Operations Management Information System (TOMIS) is a data reporting system that captures work expenditures for Traffic Operations Program activities. TOMIS enables production of a monthly report comparing workload output (production) to work effort (expenditure). Ramp Metering Branches throughout Caltrans in all 12 districts have adopted TOMIS. In TOMIS, there are six subjobs that are related to ramp metering activities. These are EA 936501, subjob 3RACT, 3RSUR, 3RPNT, and 3RTRV; and EA 936602, subjob 3RFAS and 3TRVL. The detailed descriptions of these subjobs are tabulated in the following Table 3. On a monthly basis, production units for each subjob are reported to Headquarters. These production units are also defined in Table 3. Currently, the workload standard (See Attachment 7) for 3RSUR, 3RPNT is 49 and 15 hours per widget, respectively. The workload standards for other subjobs are under development.

14. One-Lane Metering To Two-Lane Metering

Southbound Interstate 110 (Harbor Freeway) at 11th Street on-ramp was a one-lane meter with a volume of 1,200 vehicles per hour. Due to this high volume, the meter rate was modified to 3 vehicles per green due to the lack of adequate storage. In 2008, through a permit project, the ramp was widened to provide two-lane metering at one vehicle per green.

VIII. REFERENCES

1. "Ramp Meter Design Guidelines", Caltrans, January 2000.

2. **"Ramp Meter Development Plan", Wahib Jreij & Mohamed Iqbal Toorawa, April 2004.**

3. **Amended "Ramp Metering Procedure Manual", Rafael Benitez-Lopez, November 2005.**

4. "Preliminary SWARM Study Report", Hanh Pham, Caltrans District 07, November 2001.

5. "SWARM Study Final Report", Hanh Pham, Caltrans District 07, October 2002.

6. "ATMS User's Manual", National Engineering Technology Corporation, June 2000.

7. "ATMS Traffic Engineer's Manual", National Engineering Technology Corporation, June 2000.

8. "Highway Capacity Manual", Transportation Research Board, 2000.

9. "Traffic Manual", Caltrans

10. "Highway Design Manual", Caltrans

11. "Twin Cities Ramp Meter Evaluation", Cambridge Systematics Inc., November 27 2001.

12. "Traffic Bulletin No. 4 - Notes on Freeway Capacity", Karl Moskowitz and Leonard Newman, July 1962.

13. "Traffic Bulletin No. 16 – Introduction to Capacity", Leonard Newman, April 1969.

14. "Ramp Meter Operation Plan", National Engineering Technology Corporation, December 2001.

15. "Basic Ramp Control", M.K. Kim, Caltrans

16. Route 405 SWARM Study Summary, Wahib Jreij & Fady Al-Awar, Caltrans District 07, January 2003.

IX. ATTACHMENTS

ROUTE RESPONSIBILITIES

Afsaneh Razavi (Ramp Metering Branch Chief)

Phone (323) 259-1841

AREA ENGINEER: Wahib Jreij — Phone: (323) 259 -1842

Co/Rte	PM Limits	Limits	Assigned	Ph. Ext	Meters
LA-10	18.39/48.30	Route 101 to San Bernardino County	Jreij / Dumaplin	1842	81
LA-210	26.00/52.00	Route 134 to San Bernardino County	Jreij/ Dumaplin/ Akramian	1842	63
LA-57	0.00/12.00	Orange County to Route 210	Jreij / Dumaplin	1846	20
LA-60	0.00/30.50	East LA Inter. to San Bernardino Co.	Jreij / Dumaplin	1846	65
LA-71	0.30/4.80	San Bernardino County to Route 10	Jreij / Dumaplin	1846	3
LA-210	Connector	NB Rte 57 to EB Rte 210	Jreij / Dumaplin	1842	1
LA-210	Connector	NB Rte 57 to WB Rte 210	Jreij / Dumaplin	1842	1
LA-210	Connector	NB Rte 605 to EB Rte 210	Jreij / Dumaplin	1842	1
LA-210	Connector	NB Rte 605 to WB Rte 210	Jreij / Dumaplin	1842	1
				Total	**236**

AREA ENGINEER: Iqbal Toorawa — Phone: (323) 259 -1858

Co/Rte	PM Limits	Limits	Assigned	Ph. Ext	Meters
LA-91	6.01/20.74	Vermont to Orange County	Toorawa	1858	41
LA-110	0.00/20.36	Route 47 to Rte 05	Toorawa	1858	45
LA-110	20.36/31.91	Route 05 to Glenarm St. (Pasadena)	Toorawa	1858	0
LA-110	Connector	S/B 5 to S/B 110	Toorawa	1858	1
				Total	**87**

AREA ENGINEER: Jeff Le — Phone: (323) 259 -1850

Co/Rte	PM Limits	Limits	Assigned	Ph. Ext	Meters
LA-5	0.00/20.54	Orange County to Rte 110	Le / Masatsugu	1855	39
LA-710	6.80/27.38	Shoreline Dr to Valley Blvd	Le / Masatsugu	1845	36
				Total	**75**

ROUTE RESPONSIBILITIES

ATTACHMENT 1

Afsaneh Razavi (Ramp Metering Branch Chief)

Phone (323) 259-1841

AREA ENGINEER: Rafael Benitez — Phone: (323) 259 -1856

Co/Rte	PM Limits	Limits	Assigned	Ph. Ext	Meters
LA-10	1.88/18.33	PCH to East LA I/C	Benitez	1856	46
LA-105	0.00/18.14	Sepulveda (LAX) - 605	Benitez	1856	28
LA-110	Connector	(E/W)/B 105 to N/B 110	Benitez	1856	1
LA-110	Connector	E/B 105 to S/B 110	Benitez	1856	1
LA-110	Connector	W/B 105 to S/B 110	Benitez	1856	1
LA-105	Connector	N/B 405 to E/B 105	Benitez	1856	1
LA-105	Connector	S/B 405 to E/B 105	Benitez	1856	1
LA-105	Connector	N/B 110 to E/B 105	Benitez	1856	1
LA-105	Connector	S/B 110 to W/B 105	Benitez	1856	1
LA-105	Connector	S/B 110 to E/B 105	Benitez	1856	1
LA-105	Connector	N/B 710 to W/B 105	Benitez	1856	1
LA-105	Connector	N/B 710 to E/B 105	Benitez	1856	1
LA-105	Connector	S/B 710 to E/B 105	Benitez	1856	1
LA-105	Connector	S/B 710 to W/B 105	Benitez	1856	1
LA-405	Connector	E/W 105 to S/B 405	Benitez	1856	1
LA-405	Connector	W/B 105 to N/B 405	Benitez	1856	1
LA-605	Connector	E/B 105 to N/B 605	Benitez	1856	1
LA-605	Connector	E/B 105 to S/B 605	Benitez	1856	1
LA-710	Connector	E/W 105 to S/B 710	Benitez	1856	1
LA-710	Connector	E/W 105 to N/B 710	Benitez	1856	1
				Total	**92**

AREA ENGINEER: Hamid Kalkatechi — Phone: (323) 259 -1843

Co/Rte	PM Limits	Limits	Assigned	Ph. Ext	Meters
LA-5	20.54/88.61	Rte 110 to Kern County	Kalkatechi	1843	60
Ven-33	0.00/5.66	Route 101 to Casitas Vista Road	Kalkatechi	1843	0
LA-101	11.60/38.19	Rte 101/134/170 Int. to Ventura Co.	Kalkatechi / Sepanj	6306	61
Ven-101	0.00/43.62	L.A. County to Santa Barbara Co.	Kalkatechi	1843	8
Ven-126	0.00/13.24	Route 101 to Hallock Drive	Kalkatechi	1843	0
LA-138	0.00/1.80	Route 5 to Gorman Post	Kalkatechi	1843	0
LA-170	14.57/20.55	Route 101 to Route 5	Kalkatechi	1843	9
				Total	**138**

ROUTE RESPONSIBILITIES

Afsaneh Razavi (Ramp Metering Branch Chief)

Phone (323) 259-1841

AREA ENGINEER: Jack Kao				Phone: (323) 259 -1845	
Co/Rte	**PM Limits**	**Limits**	**Assigned**	**Ph. Ext**	**Meters**
LA-2	14.08/23.44	Glendale Blvd to Route 210	Kao / Atefyekta	1857	7
LA-134	0.0/13.34	Route 170 to Route 210	Kao / Akramian	1847	30
LA-605	0.00/26.00	Orange County to Route 210	Kao / Dumaplin	1846	56
				Total	**93**

AREA ENGINEER: Fady Al-Awar				Phone: (323) 259 -1844	
Co/Rte	**PM Limits**	**Limits**	**Assigned**	**Ph. Ext**	**Meters**
LA-14	24.79/77.01	Route 5 to Kern County	Al-Awar	1844	0
LA-101	0.18/11.60	Mission Rd to 101/134/170 Inter.	Al-Awar	1844	32
LA-118	0.00/14.08	Ventura County to Route 210	Al-Awar	1844	20
Ven-118	18.20/32.60	Route 23 to Los Angeles County	Al-Awar	1844	34
Ven-23	3.20/11.60	Route 101 to Route 118	Al-Awar / Sepanj	6303	23
LA-405	48.64/39.40	Route 05 to Route 101	Al-Awar	1844	19
LA-405	39.40/21.44	Route 101 to Route 105	Al-Awar / Torchin	1859	41
LA-90	0.92/3.28	Route 1 to Slauson Ave	Al-Awar / Torchin	1859	0
				Total	**169**

AREA ENGINEER: Nabil Eskander				Phone: (323) 259 - 1869	
Co/Rte	**PM Limits**	**Limits**	**Assigned**	**Ph. Ext**	**Meters**
LA-405	0.00/12.95	Orange County to Route 110	Eskander/Atefyekta	1857	37
LA-405	12.95/21.44	Route 110 to Route 105	Eskander / Torchin	1859	23
LA-210	00.00/26.00	Route 134 to Rte 5	Eskander	1869	45
LA-210	Connector	EB Rte 118 to EB Rte 210	Eskander	1869	1
LA-210	Connector	EB Rte 118 to WB Rte 210	Eskander / Benitez	1869	1
LA-210	Connector	NB Rte 2 to EB Rte 210	Eskander / Benitez	1869	1
LA-210	Connector	NB Rte 2 to WB Rte 210	Eskander / Benitez	1869	1
LA-210	Connector	EB Rte 134 to WB Rte 210	Eskander / Benitez	1869	1
				Total	**110**

California Department of Transportation
DEPUTY DIRECTIVE

Number: DD-35

Refer to Director's Policy: 08-Freeway System Management

Effective Date: 1-3-95

Supersedes: P&P 91-01

Title: Ramp Metering

POLICY

Caltrans is committed to using ramp metering as an effective traffic management strategy to maintain an efficient freeway system and protect the investment made in constructing freeways to keeping them operating at or near capacity flow rates.

DEFINITION/BACKGROUND

Ramp metering is the common method of ramp entry control. It has been an effective tool in reducing congestion on California freeways since the late 1960ís. Caltrans has installed over 1300 ramp meters throughout the state and proposes their installation on all urban freeway entrance ramps where metering will improve or maintain effective operations along freeway corridors.

RESPONSIBILITES

The Traffic Operations Program Manager is responsible for the development, review and dissemination of policies, guidelines, and procedures for ramp metering (see Ramp Metering Policy Procedures).

The State and Local Project Development Program Manager is responsible for the development and review of geometric design standards for ramp metering and supports the inclusion of ramp metering in projects within freeway segments identified in the Ramp Meter Development Plan.

District Directors are responsible for developing local agency support for ramp metering; implementing ramp metering policies and procedures; and providing justification for deviation from established policy and procedures.

APPLICABILITY

Any employees involved with ramp metering activities.

ORIGINAL SIGNED BY
LEE F. DETER
Deputy Director
Maintenance and Operations

RAMP METERING POLICY PROCEDURES

State of California
Business, Housing and Transportation Agency
Department of Transportation
Traffic Operations
August 1997

RAMP METERING POLICY PROCEDURES

I. PURPOSE

The purpose of these procedures is to provide guidelines for implementing the Department's ramp metering policy (DD-35).

II. BACKGROUND

Metering has proven to be an effective traffic operations tool to maximize the efficiency of a corridor. The primary objective of metering is to reduce congestion and the overall travel time of the total traffic stream - on both freeway and surface streets. Ramp metering reduces congestion by:

- Maintaining more consistent freeway throughput.
- Utilizing the capacity of the freeway corridor more efficiently.
- Providing incentives for increased use of carpools, vanpools, and public transit by including preferential lanes, which offer time savings to High Occupancy Vehicles (HOV) at ramp meters.

Secondary benefits include the reduction of congestion-related accidents and air pollution. Ramp meters operate most effectively when upstream mainline traffic is controlled. This control can be accomplished by installing additional ramp meters, metering freeway to freeway connectors or mainline control. These procedures focus on the implementation of ramp metering systems through a coordinated effort involving Caltrans planners, designers, operations personnel, local agency staff, the California Highway Patrol (CHP), and the public.

III. PROCEDURES

A. It is the District's responsibility to maintain an acceptable level of service on the freeway system, to make the most effective use of each transportation corridor, and to protect the public's investment in the system.

   Each District that currently operates, or expects to operate, ramp meters within the next ten years shall prepare a Ramp Meter Development Plan (RMDP) identifying the freeway segments, including freeway to freeway connectors, that are expected to be metered within this period. The RMDP should also identify freeway segments where upstream mainline control is necessary to maintain effective overall freeway operations. The RMDP shall be updated biennially and be included in local Congestion Management Plans.

B. Projects, which propose the modification of an existing interchange or the construction of a new interchange within the freeway segments identified in the RMDP, regardless of funding source, should include provisions for ramp meters. This applies to all projects that have an approved Project Study Report dated July 1991 or later (the date of the original Policy and Procedure). These provisions, as defined in the Ramp Meter Design Guidelines, should include right of way, geometric to accommodate vehicle storage and HOV bypass lanes, ramp meter equipment, and CHP enforcement areas. Projects which propose additional capacity within freeway segments identified in the RMDP shall include provisions for ramp meters and shall implement the ramp meters at all entrance ramps within the project limits. In freeway segments identified in the RMDP where mainline control is necessary to maintain effective overall freeway operation, additional freeway capacity should not be constructed without an analysis of the operational impacts to downstream segments. Districts are responsible for performing appropriate environmental studies for ramp metering projects.

C. The District will work in partnership with metropolitan planning organizations; regional transportation planning agencies, and congestion management agencies to program ramp metering projects and develop implementation plans. Coordination and consultation should be documented and concurrence may be obtained in any form the District considers appropriate.

D. The Ramp Meter Design Guidelines prepared by the Division of Traffic Operations, in cooperation with the Division of State and Local Project Development, and the CHP shall be used when designing ramp metering facilities. This document is a compilation of design information and operational practices used statewide.

E. HOV preferential lanes shall be considered wherever ramp meters are installed. The need for HOV bypass lanes should be included in the Project Study Report, Project Information Report, Project Report, and Environmental Document. If an HOV preferential lane is not included in a proposal to ramp meter, the reasons should be addressed in the appropriate document.

   The District is responsible for consulting with the CHP on project features, which affect enforcement activities such as HOV lane violations, enforcement pads, etc. Coordination and consultation should be documented.

F. When selecting the appropriate metering method for the HOV preferential lane, the following criteria should be used:

   Control: An analysis of HOV traffic volumes shall be made to determine the impact on mainline traffic flows. Where adverse impacts exist, consideration should include metering the HOV preferential lane and/or more restrictive metering of the SOV lane(s). Consideration should be given to metering the HOV preferential lane if platoons from local signalized intersections adversely affect

the operation of the freeway. Storage capacity and effects to local arterials should also be addressed.

Merge Conditions: Prior to entering the freeway, all vehicles on the on-ramp should be provided with adequate space to safely merge with each other. The safest merge condition is when the speeds of the merging vehicles are identical. When the speed differentials between HOVs and SOVs are excessive, consideration should be given to metering the HOV lane. All ramps should be designed in accordance with the Ramp Meter Design Guidelines, which detail adequate merging distances.

Enforcement: The ability to safely enforce occupancy violations of HOV lanes is essential. The CHP should be consulted for their recommendation of enforcement operations at each HOV preferential lane location.

Corridor Operations: In corridors where ramp meters are already operational, the existing metering method may be used as criteria for additional installations in the same corridor. Should alternate metering methods be proposed along a corridor, local agencies should be consulted.

The criteria listed above can be applied to new and existing ramp meter installations. If it is being applied to an existing ramp meter, the following criteria should also be used:

Accident History: The accident history of the ramp needs to be investigated. If either the ramp or any portion of the freeway within 500 feet of the ramp gore has been flagged as a high accident concentration location (Table C), each accident report should be reviewed in detail to determine whether or not the HOV operation during the metered period was a contributing factor. If evidence suggests that it could have been a contributing factor to the accident, consideration should be given to metering the HOV preferential lane.

G. Districts shall provide justification for deviation from the policy and these procedures and concurrence shall be obtained from the Headquarters Traffic Operations District Liaison. Deviations from design standards require the approval of the Project Development Coordinator in the Office of Project Planning and Design.

H. The Division of Traffic Operations provides District personnel with technical assistance and support on the design and operation of ramp meter systems and assists in the preparation of the District's RMDP.

CONTENTS OF EXCEPTION TO RAMP METERING POLICY FACT SHEET

PROJECT DESCRIPTION

Briefly describe the project. Note the type of project and/or major elements of work to be done.

RAMP METERING POLICY NON-COMPLIANCE FEATURES

Describe the proposed or existing ramp metering policy non-compliance feature(s). (Note: Deviations from advisory or mandatory design standards shall be addressed as required by the *Project Development Procedures Manual,* the *Highway Design Manual* and applicable District Directives.) Design exceptions to standards to be attached to Ramp Meter Policy Fact Sheet.

REASON FOR THE EXCEPTION

Be thorough but brief. Supportive factors may include right-of-way or space constraints, environmental concerns, inordinate costs, etc. Show an estimate of the added cost above the proposed project cost that would be required to conform to the ramp metering policy for which exception is being documented. The estimate does not have to be highly developed but must be realistic.

FUTURE CONSTRUCTION

Describe any planned future projects in the immediate vicinity of the requested ramp meter exception, but do not make any commitments (e.g., ramp metering as part of future projects) unless there is a certainty that they can be followed through.

PROPOSED EXCEPTION REVIEWS AND CONCURRENCE

Note reviews by HQ Traffic Operations, the District Liaison and District Office of Traffic Systems. Give dates of reviews and discuss any comments that were made and their disposition.

REMARKS

Note clarifying remarks. Discuss impacts on project delivery schedule and project costs, if any. Discuss impacts of ramp metering policy non-compliance features.

ATTACHMENTS

Provide a locations map and/or vicinity map for the project, indicating the location of the requested exception(s) to the ramp metering policy. Also provide cross-sections and/or special details as necessary to illustrate the policy non-compliance condition. Letters, resolutions, traffic studies, etc., which help to clarify the reasons for the exception request, may be attached.

SIGNATURE SHEET

The Fact Sheet signature page shall conform to the attached.

Dist-Co-Rte-KP
Source Unit – EA
Project Cost

FACT SHEET

EXCEPTION TO
RAMP METERING POLICY

(Insert Registered C.E. Seal)

Prepared by:

(Name), Registered C.E.	Date	Telephone

Approval recommended by:

(Name), Project Manager	Date	Telephone

Concurrence by:

(Name), District Liaison HQ Traffic Operations	Date	Telephone

Approved by:

(Name), District Division Chief, Operations	Date

State of California Business, Housing and Transportation Agency

Memorandum

To: DISTRICT DIVISION CHIEFS – Operations
DISTRICT DIVISION CHIEFS – Design
DISTRICT DIVISION CHIEFS – Planning

Date: July 31, 2000

File:

From: DEPARTMENT OF TRANSPORTATION
Traffic Operations
Mail Station 36

Subject: Ramp Metering Policy on High Occupancy Vehicle (HOV) Preferential Lanes

The purpose of this memorandum is to clarify and re-affirm the California Department of Transportation (Caltrans) policy on HOV preferential lanes at ramp meter locations. Caltrans is committed to its current policy: **An HOV preferential lane shall be provided at all ramp meter locations.**

The January 2000 edition of the Ramp Meter Design Manual now addresses the circumstances under which exceptions to this policy may be warranted. See 'Modifications to Existing HOV Preferential Lanes' located in Section 'I' of Chapter One:

- Underutilization of an existing lane plus the need for additional right-of-way for storage
- The availability of an alternate HOV entrance ramp within 2 Km
- The availability of a direct HOV access (drop) ramp

Exceptions shall be handled on a location-by-location basis. Conversions may require Federal Highway Administration actions or concurrence. The District Division Chief for Operations, in consultation with the Headquarters Traffic Operations Liaison, is responsible for approving and documenting decisions to remove HOV preferential lanes. These policies and exceptions also apply to new and reconstruction projects. Districts should refer to the "Exception to Ramp Metering Policy" located in the Appendix of the Ramp Meter Design Manual or contact your Headquarters Traffic Operations Liaison for assistance.

Original Signed By

KIM NYSTROM
Program Manager
Traffic Operations

cc: Mr. Robert Buckley
Program Manager
Design and Local Programs

Ms. Joan Sollenberger
Program Manager
Transportation Planning

Division of Traffic Operations
Office of System Management Operations
EA 936501
Sub Job: 3RACT
ACTIVATION OF NEW, INACTIVE OR REPLACED RAMP METERS

DESCRIPTION: This work segment captures production and timesheet charges for activating new ramp metering field elements when a capital outlay support EA is NOT available.

TYPICAL TASKS (District):

- Public awareness
- Notification of the California Highway Patrol (CHP) and request support, if necessary
- Notification of the affected local agencies and request support, if necessary
- Notification of the Caltrans Headquarters Division of Traffic Operations and Division of Maintenance
- Field walk-through before turn-on
- Activation of ramp meters
- Fine tuning of field elements and metering rates, if necessary
- Conduct before and after studies
- Ramp metering operations support during construction
- Coordinate with TMC support, electrical maintenance, and construction prior to activation
- Negotiate inter-agency protocols and agreements
- Respond to inquiries (internal and external)
- Participate in specification development and procurement process

TYPICAL TASKS (Headquarters):

- None.

TASKS NOT INCLUDED:

- Activation of new, inactive or replaced ramp meters for Encroachment Permit, Capital Outlay Project, or Maintenance (use EA XXXXXX – XXXXXX and Sub Job XXXXX or WBS XXXXX or Family Code respectively)
- Surveillance and adjustment of existing ramp meters (use EA 936501, Sub Job 3RSUR)
- Data collection and analysis related to Operational Investigations (use EA XXXXXX, Sub Job 3OPIN)
- Project development activities, including construction of new signals (use COS Project EA with appropriate WBS activity code)
- Travel time to complete activation (use Travel EA 936603 and Sub Job 3RACT)
- Surveillance and adjustment of traffic signals other than ramp meters (use EA XXXXX, Sub Job XXXXX – XXXXX)

PRODUCTION STANDARDS:

Production Unit:

- Number of ramp meters activated

Workload Standard:

- 40 hours per activation

Performance Measure:

- TBD

PREVIOUS EA: 936501 Ramp Metering, Sub Job 3RAMP

NOTES: None.

DATE MODIFIED: 1-31-2008

Division of Traffic Operations
Office of System Management Operations
EA 936501
Sub Job: 3RSUR
SURVEILLANCE AND ADJUSTMENT OF EXISTING RAMP METERS

DESCRIPTION: This work segment captures production and time sheet charges for the surveillance and adjustment of existing ramp metering office and field elements.

TYPICAL TASKS (District):

- CONDUCT FIELD/OFFICE ELEMENT SURVEILLANCE
  - Monitor ramp meter functionality in the field
  - Monitor ramp meter functionality through a central system in the office
  - Review & adjust corridor ramp metering hours (am, pm, or all day for both weekdays & weekends).
  - Inspect firmware (SATMS/SDRMS/TOS) and hardware in the field.
  - Report hardware or communication problems to appropriate functional units such as TMC support, electrical maintenance and TMS support.
  - Investigate and respond to inquiries/complaints
  - Respond to inquiries (internal and external)
  - Respond to legal claims inquiries
- COLLECT TRAFFIC DATA
  - Occupancy counts
  - Queue and demand
  - ramp geometry
  - ramp volumes
  - Mainline volumes
  - Turning movements at the ramp termini
  - meter violation rates
  - HOV (Bypass) counts
  - HOV (Bypass) Violation rates
  - Maintain and update log of surveillance results
- ANALYZE TRAFFIC DATA
  - Analyze traffic data
  - HOV (Bypass) analysis
  - Corridor analysis
  - Analyze violation rates
  - Develop recommendations and implementation plans
  - Conduct before and after studies
- ADJUST FIELD ELEMENTS
  - Adjust ramp meter equipment such as detector settings.
  - Adjust metering parameters (rate, traffic responsive thresholds, holiday timing plans, etc.)
  - Maintain log of ramp metering changes (including meter timing)
  - Efforts & coordination with maint. and other internal/external offices To restore the knock-downs
- SUPPORT OPERATIONAL IMPROVEMENT
  - Obtain data from ATMS, RMIS or other sources
  - Develop ramp meter operational study for each freeway
  - Develop plans for operational improvement
  - Generate the improvement report
  - Implement and evaluate the improvement
- CONDUCT YEARLY INVENTORY
  - Conduct inventory of each RMS and VDS/TMS
  - Report findings to TMC support and/or electrical maintenance, Headquarters

TYPICAL TASKS (Headquarters):

- None.

TASKS NOT INCLUDED:

- Activation of new, inactive or replaced ramp meters (use EA 936501, Sub Job 3RACT)
- Data collection and analysis related to Operational Investigations (use EA XXXXXX, Sub Job 3OPIN)
- Project development activities, including developing metering plans for new metered systems (use COS Project EA with appropriate WBS activity code)
- Travel time to conduct the surveillance and adjustment (use travel EA 936603 Sub Job 3RSUR)
- Surveillance or adjustment of signals other than ramp meters (use EA XXXXX, Sub Job XXXXX – XXXXX)

PRODUCTION STANDARDS:

Production Unit:

- Number of production units adjusting/reviewing ramp meters

Workload Standard:

- 49 hours per production unit

Performance Measure:

- TBD

PREVIOUS EA: 936501 Ramp Metering, Sub Job 3RAMP

NOTES: None.

DATE MODIFIED: 1-31-2008

Division of Traffic Operations
Office of System Management Operations
EA 936501
Sub Job: 3RPNT
SYSTEM PLANNING AND IMPLEMENTATION OF NEW TECHNOLOGIES

DESCRIPTION: This work segment captures production and timesheet charges for support of corridor- or system-level ramp metering system planning and new technology implementation support effort, such as simulation and algorithm and field element testing.

TYPICAL TASKS (District):

- Corridor- or system-level intelligent ramp metering strategy studies
- Street traffic signal and ramp metering operation coordination studies
- Testing of new ramp metering algorithms and new field elements
- Provide support for District System Management Plan (DSMP)
    - Provide congestion/Delay data
    - Provide field element inventory data
    - Coordination with planning/local agencies/externals
    - Develop system-wide strategies in coordination with Planning (and other Caltrans Districts/Divisions)
- Consultant service oversight
- Update Ramp Metering Development Plan
- Ramp meter annual report
- Prepare and monitor budget, resource allocations and expenditures
- Develop and monitor workload standards, performance indicators, and outcomes
- Develop and or participate in training
- Participate in statewide meetings
- Other studies

TYPICAL TASKS (Headquarters):

- Coordinate statewide activities
- Review workload data
- Report statewide activities

TASKS NOT INCLUDED:

- Activation of new, inactive or replaced ramp meters, supported by either COS EA or EA 936501 3RACT
- Surveillance and adjustment of ramp meters (use EA 936501, Sub Job 3RSUR)
- The Congestion Monitoring Component of the DSMP (use EA XXXXXX, Sub Job XXXXX)
- Data collection and analysis related to Operational Investigations (use EA XXXXXX, Sub Job XXXXX)
- Project development activities, including construction of new ramp meters (use COS Project EA with appropriate WBS activity code)
- Travel time to complete planning and implementation of new technologies (use Travel EA 936603 and Sub Job 3RPNT)
- Surveillance or adjustment of signals (use EA XXXXX, Sub Job XXXXX)

PRODUCTION STANDARDS:

Production Unit:

- Number of production units implementing new technologies

Workload Standard:

- 15 hours per production unit

Performance Measure:

- TBD

PREVIOUS EA: 936501 Ramp Metering, Sub Job 3RAMP

NOTES: None.

DATE MODIFIED: 1-31-2008

Division of Traffic Operations
Office of ITS
EA 936602
Sub Job: 3RFAS
RAMP METER FIRMWARE AND CENTRAL APPLICATION SUPPORT

DESCRIPTION: This work segment captures production and time sheet charges for the ramp metering firmware and application support effort, such as the ramp metering firmware and central system control, monitoring, testing, calibrating, maintaining and upgrading.

TYPICAL TASKS:

Central Application Support

- Diagnose, troubleshoot, configure, optimize and maintain system.
- Provide System and Database Administration.
- Develop and maintain system documentation for future expansion, system integration and support.
- Specify, procure and coordinate equipment upgrades.
- Contract Management for hardware and software support.
- Data validation, archiving, performance testing and report generation.
- Develop and support Configuration Management plan.
- Develop operational instructions and provide training for TMC operators and support staff.
- Sustaining Engineering.
- Support MPOs, HQ and other districts.
- Develop and document system design.
- Prepare and update Policies and Guidelines
- Maintain a Statewide Inventory.
- Regional and National ITS Architecture support.
- Standardize and Develop system specifications.
- Participate in statewide system planning activities and develop/maintain a district plan.
- Coordinate with HQ-IT and other Caltrans' Divisions

Firmware Support

- Maintain and support process control firmware applications
- Add new features and updates.
- Test and troubleshoot new features.
- Coordinate statewide testing and implementation.
- Develop and provide training workshops and classes.
- Investigate new technologies and coordinate technology upgrades.
- Coordinate with other districts/HQ traffic operations

TASKS NOT INCLUDED:

- All activities captured by EA 936501 subjob 3RACT, 3RSUR, and 3RPNT
- Travel time to conduct firmware and central application support (use travel EA 936603 subjob 3RFAS)
- All activities captured by any EA other than ramp metering support

PRODUCTION STANDARDS:

Output:

Production Unit:

- Ramp metering firmware and central system support.

Workload Standard:

- 2 PY a year

Performance Measure:
- TBD

PREVIOUS EA: 936501 Ramp Metering, Sub Job 3RAMP

NOTES: None.

DATE MODIFIED: 1-31-2008

Division of Traffic Operations
Office of System Management Operations
EA 936603
Sub Job: 3RAMP
TRAVEL FOR RAMP METERING ACTIVITIES

DESCRIPTION: This work segment captures time sheet charges for travel to and from the field related to ramp metering activities such as ramp meter activation, surveillance and new technology implementation. Any travel time that is longer than 15 minutes should be captured. Travel time hopping between work activities shall be captured as work time instead of travel time, unless it is longer than 15 minutes.

TYPICAL TASKS:

- Travel from origin (District Office) to the closest field site and back

TASKS NOT INCLUDED:

- Time to conduct ramp metering activities which should be charged to EA 936501 other than the traveling.

PRODUCTION STANDARDS:

Production Unit:

- Travel required to and from field site to perform ramp metering activities.

Workload Standard:

- Total annual travel hours

Performance Measure:

- TBD

PREVIOUS EA: 936501 Ramp Metering, Sub Job 3RAMP

NOTES: None.

DATE MODIFIED: 1-31-2008

Division of Traffic Operations
Office of System Management Operations
EA 936603
SUBJOB: 3TMSU
TRAVEL

DESCRIPTION: This work segment captures time sheet charges for travel to and from the field related to ramp meter firmware and central application support.

TYPICAL TASKS:
- Travel from origin (District Office) to the closest field site and back

TASKS NOT INCLUDED:
- Time to conduct ramp metering activities which should be charged to EA 936501 other than the traveling.

PRODUCTION STANDARDS:

Production Unit:
- Travel required to and from field site to perform ramp metering activities.

Workload Standard:
- Total annual travel hours

Performance Measure:
- TBD

PREVIOUS EA: 936501 Ramp Metering, Sub Job 3RAMP

NOTES: None.

DATE MODIFIED: 1-31-2008

EA 936501
RAMP METERING
Sub Job: 3RAMP (revised 3/4/2003)

DESCRIPTION:

This work segment captures production and time sheet charges for the ramp-metering program.

TYPICAL TASKS:

- Activating New Ramp Meter which includes:
  Public Awareness
  Negotiation with locals and/or Law enforcement agencies
  Corridor data collection, monitoring, evaluation, adjustment and documentation
- Monitoring, evaluating, adjusting and documenting operation of existing ramp metering systems and operating systems.
- Operational Improvement
- Conduct Yearly inventory
- Developing and maintaining Ramp Meter Development Plan.
- Diagnosing and troubleshooting /reporting electrical problems related to ramp metering systems
- Participate in Development of District System Management Plan:
  Coordination with external agencies
  Develop system-wide strategies in coordination with planning and other Caltrans Districts/Divisions
  Data Collection and Analysis
- Data collection, analysis, and negotiation with local agencies related to corridor ramp metering plans
- Respond to inquiries from elected officials, external/internal agencies and the public

TASKS NOT INCLUDED:

- Project development activities, including developing metering plans for new meter systems, preparation of PSRs, PSSRs, PRs, and PS&E for specific projects (use COS Project EA, with appropriate WBS activity code).
- Construction of ramp meters (use COS Project EA, with appropriate WBS activity code).
- Maintenance of ramp meters (Maintenance).

WORKLOAD STANDARDS:

Production Units = Number of ramp meter locations inspected.

Workload Standard = 50 hours per ramp meter/ramp meter location reviewed and /or adjusted.

Performance Indicator = Travel time, Travel time reliability, number of incidents

Sub job Descriptions:

- 3RAMP - All above mentioned and otherwise routine Ramp Metering activities including all training, travel and administrative activities directly related to Ramp Metering.

PREVIOUS EXPENDITURE AUTHORIZATIONS:

936203	Work Segment OP11	Ramp Metering

NOTES:

(1) Software/Hardware development charges for this activity should include Special Designation "6SOFTWARE".