PERFORMANCE MONITORING AND PRICING PILOT PROJECT (DEPLOYMENT PHASE)

Application for Participation in the FHWA Value Pricing Pilot Program

Proposed to:

FHWA

Value Pricing Pilot Program

Proposed by:

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1.0 INTRODUCTION

1.1 Purpose

This proposal is being submitted by the Orange County Transportation Authority (OCTA) for participation in the Federal Highway Administration (FHWA) Value Pricing Pilot Program. OCTA is submitting the Performance Monitoring and Pricing Pilot Project (PMAP^3) for consideration by FHWA as part of their program. PMAP^3 is a value/dynamic pricing project for the 91 Express Lanes, a toll facility providing two lanes in each direction in the median of the Riverside Freeway/State Route 91 (SR-91) for a ten mile stretch in eastern Orange County. OCTA has been reviewing methods for improving the operations, efficiency, and customer experience of the 91 Express Lanes since taking ownership of the facility in 2003. The 91 Express Lanes is recognized internationally as one of a handful of operational facilities where congestion pricing techniques are applied.

PMAP3 is not another study of value pricing theory; it provides for a real-world value pricing pilot implementation-test on one of the most studied toll facilities in North America.

The concept for PMAP^3 was initiated through a cooperative Orange and Riverside intercounty effort, with the goal of maximizing throughput and efficiency of the SR-91 corridor and the 91 Express Lanes. As shown in Figure 1, PMAP^3 will move the 91 Express Lanes from the current approach using non-real-time "value pricing" to the more sophisticated subset of value pricing which can be described as "dynamic pricing." Dynamic pricing applies value pricing concepts on a real-time basis with continuous monitoring of traffic conditions. In some sense, this is similar to what is being done on I-15 in San Diego, however PMAP^3 would provide for a much more sophisticated implementation involving the continuous comparison of traffic conditions on the 91 Express Lanes versus the adjoining main lanes of SR91.

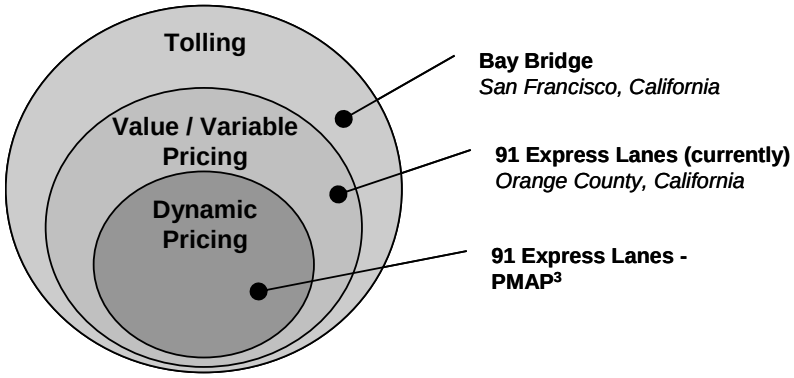

Figure 1 - Dynamic Pricing as a Subset of Value Pricing

Work efforts on the initial phase of PMAP^3 have been underway since mid-2004, and OCTA believes that the pilot project is ready to move to the testing and deployment stages. Therefore, this application is focused around deployment and testing of a real-world operational pricing pilot project.

This proposal highlights why PMAP^3 would be an excellent addition to FHWA's Value Pricing Pilot Program effort, and provides the information requested by FHWA through their application process.

1.2 Unique Characteristics of the 91 Express Lanes and PMAP^3

There are several unique characteristics of the 91 Express Lanes and PMAP^3 that make them well suited to FHWA's Value Pricing Pilot Program effort. These characteristics are:

- **Unique Characteristics of 91 Express Lanes:**
  - Operational objectives – Unlike some managed lanes facilities under development, where the objective is simply to make better use of underutilized HOV capacity, the 91 Express Lanes is focused on providing a reliable and consistent service to customers. The focus on customer service is a sound testing ground for advanced value pricing techniques, as customer expectations are comparatively high.
  - Long operational history – The 91 Express Lanes have been in continuous 24/7 operation since December 1995 providing an extensive history to draw upon for any "before" conditions assessments.
  - Agency ownership and control – OCTA took over ownership and operations of the facility in January 2003, and this allowed for a toll approach that balances the needs for revenue with the broader need for enhancing overall corridor throughput. This is an important distinction from a private or consortium owned toll facility.
  - Well operated and equipped facility – The 91 Express Lanes is fully equipped with surveillance, toll collection, and enforcement systems, and all necessary operational procedures are well established and supported by trained staff.
  - Number and extent of previous studies – Several agency and academic studies have been conducted on the 91 Express Lanes and the impacts of the current approaches to value pricing. Comprehensive studies such as those conducted by Cal Poly Pomona, provide a wealth of data for considering socio-economic impacts associated with changing pricing methods.
- **Unique Characteristics of PMAP^3:**
  - Ready to move to deployment and testing phases – Unlike many value pricing projects which are still in the conceptual stages, PMAP^3 is ready to move to testing and deployment phases.
  - More complete approach to value pricing – To our knowledge, PMAP^3 will be the first implementation of its type to implement dynamic pricing with consideration of traffic conditions both on the toll and adjoining main lanes, and to do so in an environment that includes the protection of revenue to fulfill bond covenants.
  - Availability of support systems – The 91 Express Lanes provide a sound level of support systems (communications, toll systems, customer service, etc.) and staff to support the implementation of PMAP^3.
  - Interest and previous involvement of stakeholders – The concept for PMAP^3 stemmed from an intercounty cooperative effort, and the development efforts to date for PMAP^3 have involved key stakeholders in the 91 Express Lanes.

Taken together, these characteristics ensure that PMAP^3 can move forward more quickly and attempt more advanced pricing techniques than most other facilities where dynamic pricing might be tested.

1.3 Background

Figure 2 displays the location of the 91 Express Lanes in the Southern California region.

Figure 2 - Location of the 91 Express Lanes

Effective January 3, 2003, OCTA took ownership of the 91 Express Lanes from a private toll consortium. OCTA's primary stated operating objective of the 91 Express Lanes is to, "provide a safe, reliable, predictable commute for 91 Express Lanes customers." As part of taking ownership of the 91 Express Lanes, OCTA is responsible for servicing bonds that financed the purchase. A primary focus of OCTA taking ownership was to eliminate a non-compete clause which prevented improvements to the normal lanes of SR-91 in the vicinity of the 91 Express Lanes. OCTA now utilizes funds from the 91 Express Lanes to:

- Support operations and maintenance of the Express Lanes and the associated systems, facilities, and services;
- Service the financial bonds; and
- Fund improvements to the adjoining main lanes and approaches of SR-91 in the vicinity of the Express Lanes.

The current major systems and software operational on the Express Lanes include:

- TollPro software (by NLDC),
- Electronic Toll Systems/Violation System Software (by SIRIT),
- Customized Traffic Management System (TMS),
- CCTV Control & Viewing/Recording System, and

- Variable Message Sign (VMS) control software and signs.
- Field sensors including:
  - 28 sets of Express Lane dual-loop in pavement sensors (8 of which also cover the SR-91 main lanes),
  - 35 CCTV cameras,
  - RF tag readers, and
  - Toll enforcement field equipment including license plate readers, video, etc. at the tolling point.

The PMAP^3 project effort will supplement the functionality of the existing systems to allow for the shift to dynamic pricing. It should be noted that tentative plans are in place to upgrade the traffic management systems, CCTV cameras, and Variable Message Signs (VMS) system components, perhaps as soon as late 2005. The tolling and toll enforcement components of the system were recently updated (2004). The recent and planned upgrades are an essential component of supporting dynamic pricing and the PMAP^3 effort.

1.4 Attachments

There are three attachments provided with this proposal as background information:

- **Attachment A – Glossary of Terms and Acronyms** defines some of the common terms used in the PMAP^3 development effort.
- **Attachment B – PMAP^3 Concept of Operations** outlines the existing traffic management and electronic toll systems, changes called for under PMAP^3, reasons for these changes, and the PMAP^3 operational scenarios.
- **Attachment C - Initial Report on Toll Road Speed and Travel Monitoring** summarizes information provided to the OCTA Board and 91 Express Lanes stakeholders on the available sensor technologies which can support dynamic pricing.

2.0 CONGESTION PROBLEM TO BE ADDRESSED

The SR-91 freeway serving travel between Orange County and Riverside County is one of the most congested freeways in Southern California. Everyday, thousands of Riverside and Orange County residents experience commute times of up to 3 hours to get to work and return home.

Each day, more than one-quarter of a million vehicles travel between Riverside and Orange County. As shown by Figure 3, with only two choices of roadways, SR-91 in the north and the narrow, two-lane Ortega Highway in the south, it is easy to understand why this commute has become so difficult. In addition, the number of trips forecasted over the next 20 years is expected to reach 440,000 ADT. The Orange County Transportation Authority (OCTA) and the Riverside County Transportation Commission (RCTC) take this problem very seriously and are working together to find transportation solutions that will ease the commute for residents on both sides of the county line.

As shown in Figure 4, SR-91 must deal with the large majority of intercounty traffic. SR-91 has become a choke-point, and the 91 Express Lanes are located at the center of the distribution of this intercounty traffic.

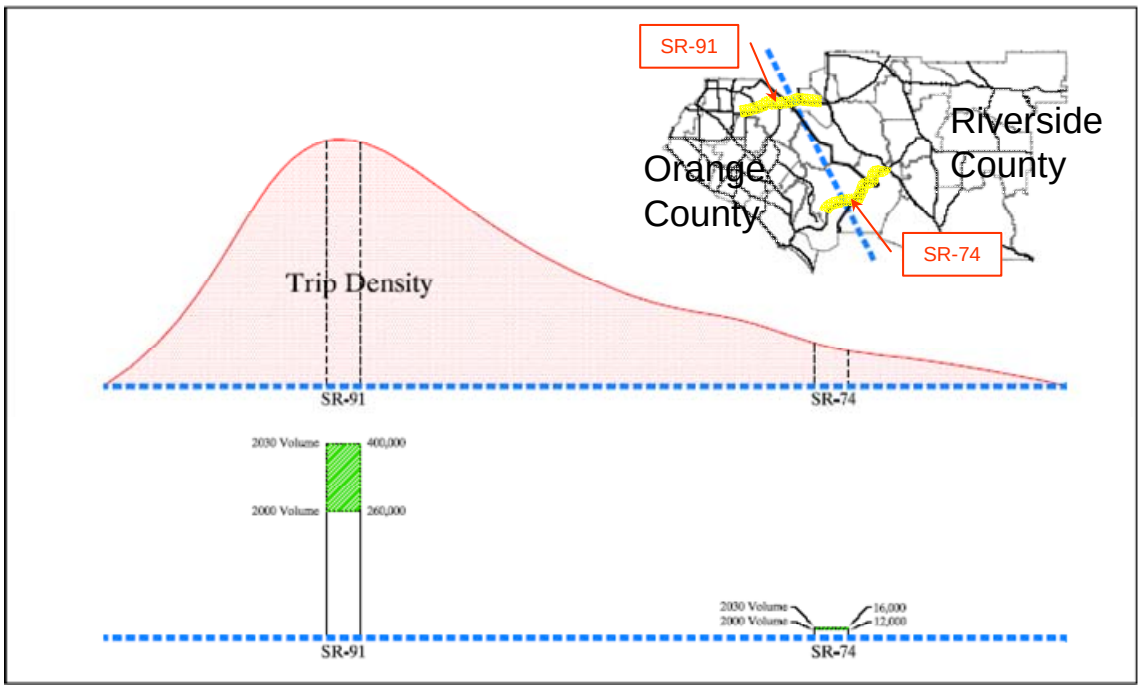

Figure 3 - SR-91 Existing and Forecast ADT

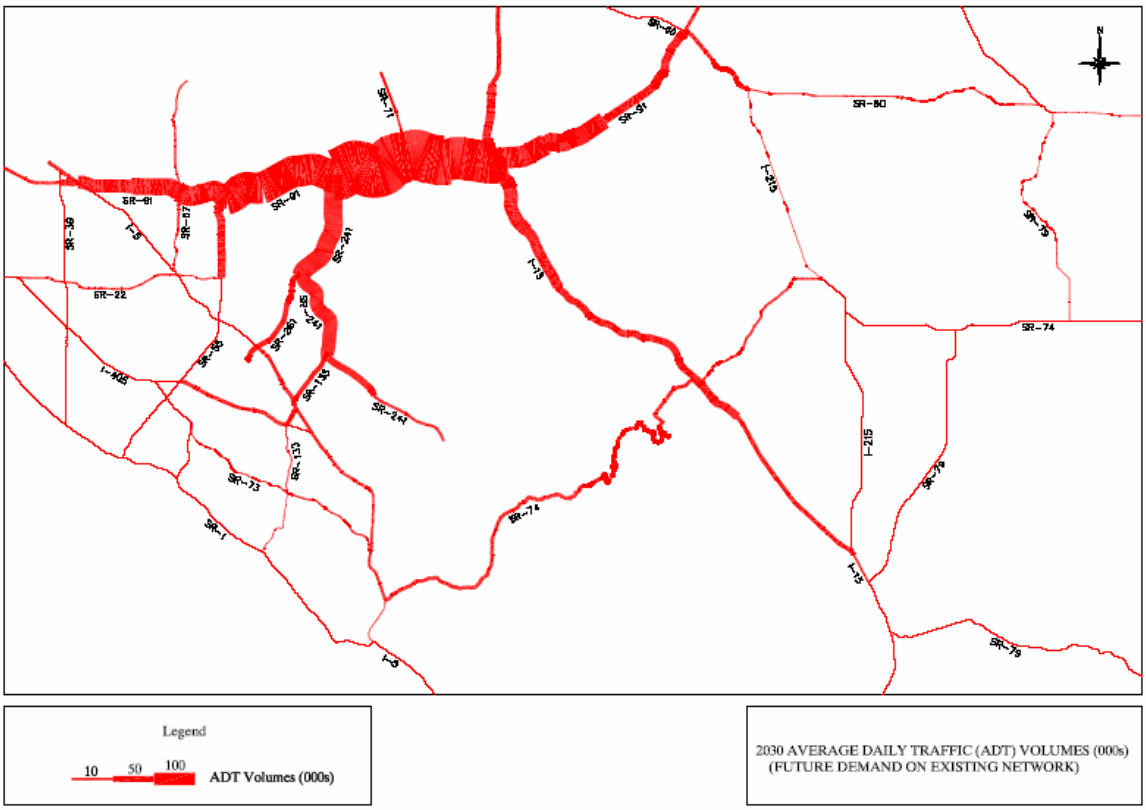

Figure 4 - Distribution of Intercounty Traffic

A little over two years ago, OCTA's Board of Directors requested its staff explore alternatives to reduce congestion on the SR-91. Since that call to action, many things have been accomplished or are in the works. One of the actions taken was OCTA's purchase of the 91 Express Lanes, which removed the restrictions to future expansion of the SR-91. Eliminating the so-called "non-compete" provision in the toll road franchise agreement with the State of California, Department of Transportation (Caltrans), afforded OCTA, Caltrans and the Riverside County Transportation Commission (RCTC) the opportunity to plan, design and construct improvements to the 91 which would otherwise have been prohibited. Improving the throughput of the SR-91 main lanes and the 91 Express Lanes is seen as a primary part of the overall solution. PMAP^3 promises to provide some of the enhanced efficiencies and throughput that the region is seeking.

3.0 PROPOSED PRICING PROGRAM DESCRIPTION AND GOALS

The objectives and basic system components of the PMAP^3 project are outlined below.

3.1 PMAP^3 Objectives and Measures

Table 1 lists the objectives for the PMAP^3 project. Methods or measurements for determining whether or not an objective has been met are also listed.

Table 1 – PMAP^3 Project Objectives and Measures

Objective	Measures
Ensure required revenue level from the 91 Express Lanes by providing reliable service and revenue neutral or positive approaches to dynamic pricing schemes.	Actual toll revenue => anticipated revenue
Maximize efficiency and vehicle throughput of the 91 Express Lanes and main lanes during peak commute hours	VPHPL and average speeds over period of time
Improve reliability and consistency of travel time for customers of the Express Lanes (including more rapid incident response with Toll TOC to CT TMC integration & data exchange).	End to end travel time over period of time
Provide enhanced and accurate speed and travel time data for the Express Lanes	Comparison of existing and future speed and travel time data over period of time
Provide enhanced and accurate speed and travel time data for the main lanes of SR91	Comparison of existing and future speed and travel time data over period of time
Establish a pricing scheme that takes into account conditions on the SR91 main lanes in addition to the Express Lanes	Implementation of pricing scheme including main lane speed information
Provide for customers a visible and easily understandable link between the toll they pay and the travel time and speed along the facility	Customer feed back

The most critical objective is ensuring the level of revenues necessary to service the bonds for the 91 Express Lanes. Revenue from the facility is also used to fund improvements along portions of SR-91 and protecting revenue for these planned projects is crucial politically. Objectives may be added or adjusted over time, but measurement of eventual PMAP[3] project performance against the initially defined objectives is important to maintain.

3.2 Overview of System Components and Changes

The PMAP[3] project consists of several components that include both existing and new systems. These components are briefly discussed at a high level to provide a basis for better understanding what is proposed under PMAP[3]. Figure 3 displays the basic system components that are involved in the PMAP[3] effort, followed by a brief description of each.

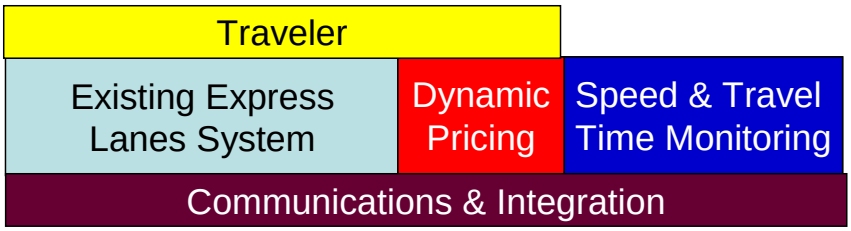

Figure 5 - PMAP[3] System Components Overview

At a more detailed level these components breakdown into:

- Field Detection/Sensors (Speed & Travel Time Monitoring) – Supplemental field sensors will be required to collect speed and travel time data from the Express Lanes, main lanes, and approaches to the Express Lanes. The supplemental sensors to be deployed in support of PMAP[3] will be comprised of a combination of toll tag readers and traditional non-intrusive volume/speed sensors.
- Field Communications – The Express Lanes currently have fiber-optic communications to a series of existing field devices including loops, surveillance cameras, and ETC equipment. These communications will be required to support field devices for PMAP[3]; however some modifications will be required to support all desired devices and locations for data collection.
- Dynamic Pricing Module – The dynamic pricing module is the component which makes decisions regarding the customer price to use the facility based on data from the speed and travel time monitoring system, as well as the dynamic pricing algorithm and rule set. The extent to which this component is separate from existing ETC components is still being determined.
- Existing Express Lane System (TMS/ETC Components) – These are the established components of the existing toll system including tags, toll lane controllers, video enforcement, vehicle detection, pricing and information Variable Message Signs (VMS), as well as the traffic management system (TMS)
- System to System Integration and Communications – Communications between the dynamic pricing system and the ETC/ETTM components will likely all occur within the existing SR91 management facility or in the field in proximity to the toll system lane controller.

- Traveler or Customer – The existing and potential customers of the 91 Express Lanes are an important component of the overall system. Information must be clearly relayed to the customer in a relatively narrow decision making window. In addition, dynamic pricing may impact the customer from customer service or complaint management perspectives.

Very high levels of reliability and consistency of system performance are desired for PMAP^3, as the system will involve toll revenues fluctuating based on the information obtained from field sensors on an on-going basis.

Table 2 summarizes the changes that will be required to the existing systems to support PMAP^3 deployment.

Table 2 – Summary of Desired System Changes/Additions

Desired Changes	
1	Deployment of additional field sensor locations to provide data on: • Express Lanes (travel times, speeds, and volumes) • Main Lanes (travel times, speeds, and volumes) Collection of data needs to occur on a 24/7 real-time basis. Sensors should cover the approaches to, mid-sections, and departure points of the Express Lanes, as well as the adjoining main lanes.
2	Deployment of (or integration with existing) appropriate supporting communications to transmit data from the field sensors to the systems at the roadside facility and TOC.
3	Deployment of (or integration with existing) hardware and software necessary to display, store, and report data from the field sensors. Traffic conditions data will be processed at minimum intervals of 30 seconds, 6 minutes, 15 minutes, and an hour.
4	Provide the capability to review, analyze, aggregate, average, and check traffic conditions data to provide for end to end travel time estimates for the Express Lanes and main lanes.
5	Develop software which implements the dynamic pricing algorithm and rule set using information from the field hardware and sensors.
6	Develop interface between the dynamic pricing software and the existing Electronic Toll Collection System to trigger pricing adjustments as may be appropriate.
7	Provide the ability to turn on/off dynamic pricing components to allow TOC Operators to revert to time of day pricing should it be necessary. As a related change, provide a manual override function which would shut-down tolling, but maintain traffic conditions monitoring functions.
8	Provision of traffic conditions data to the Caltrans TMC (communications from Caltrans to the Express Lanes TOC being a Caltrans responsibility)
9	Provide OCTA program managers and planners the ability to easily view traffic conditions historical data for monitoring, evaluation, and planning purposes.
10	Continue to support HOV 3+ policies allowing for a lower toll rate for HOV 3+ vehicles.
11	Improve or ensure high levels of reliability of overall system.

Detailed functional and performance requirements will be identified as a part of the PMAP[3] System Specifications. Additional details on the desired changes of PMAP[3] and their operational implications are included in the Concept of Operations (Attachment A).

3.3 Dynamic Pricing Modes and Operations

Analyses have been undertaken to prepare a preliminary test dynamic pricing algorithm for PMAP[3]. This algorithm allows for four potential pricing modes or dynamic pricing operational conditions which are displayed in Figure 4:

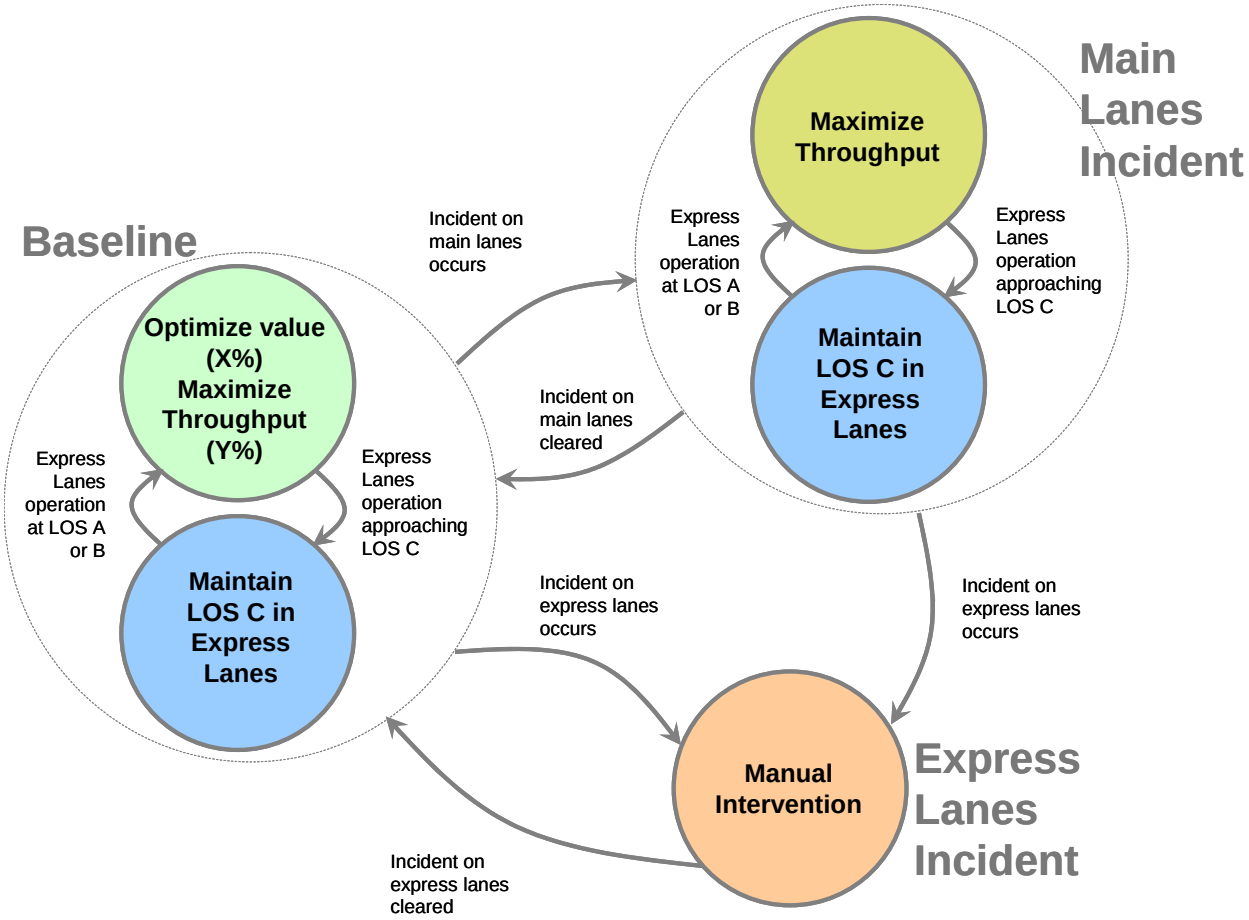

Figure 6 - PMAP[3] Pricing Modes and States

- **Basic Dynamic Pricing** - This mode is shown as green in Figure 4. Under the basic dynamic pricing mode, the pricing rule set works only to optimize the toll policy goal of maximizing throughput on the overall facility at X% priority and optimizing value on express lanes at Y% priority. In order to develop this pricing mode, the market for the express lanes was analyzed and the priorities for value optimization and throughput maximization were determined.
- **Incident Mitigation** - This mode is shown as yellow in Figure 4. Under the incident mitigation mode, the pricing rule set works to optimize overall facility throughput.

- **LOS Maintenance** - This mode is shown as blue in the state diagram. Under LOS maintenance mode, the pricing rule set works only to move demand out of the express lanes and onto the main lanes until LOS C is achieved. Because this rule set uses a myopic goal seeking approach, it does not require a market analysis.
- **Manual Intervention** - This mode is shown as orange in the state diagram. This mode of operation occurs when there is an incident on the express lanes or when operators override the current system pricing. This mode is also explained in greater detail below and general manual operating procedures are proposed.

Each of these pricing modes is organized into three super states that represent the full range of possible operational situations on the Express Lanes. Most times, the algorithm will be in the baseline state, but will shift to one of the incident states should an incident be identified by the TOC Operators.

Analyses were based on available data on volumes, speeds, and toll rates. The current test dynamic pricing algorithm is directly based on existing OCTA toll policy which effectively strikes a balance between revenue requirements and corridor throughput.

4.0 SOCIAL AND ECONOMIC EFFECTS

Unique when compared with many other toll facilities, significant studies have been conducted to assess the socio-economic effects of the existing methods of value pricing used on the 91 Express Lanes. The most significant of these was the Cal Poly SR 91 impact study, which was conducted to understand the traffic and travel behavior consequences of opening the 91 Value-Priced Express Lanes. The investigation addressed changes which occurred through more than a five year period, from 1994 (about a year and a half before the Express Lanes opened in December 1995) through 1999. The period of observation concluded in late 1999. The final report was published in 2000. This study provides a rich data set for the “before” condition, prior to implementing PMAP^3 efforts.

The specific socio-economic impacts of PMAP^3 have yet to be assessed, however they are anticipated to be rather minimal as PMAP^3 implementation is not expected to significantly alter existing OCTA toll policy. The intercounty SR-91 Advisory Committee has provided input that methods of enhancing or promoting HOV3+ carpools should be considered as part of the PMAP^3 efforts. Potential methods are currently under review.

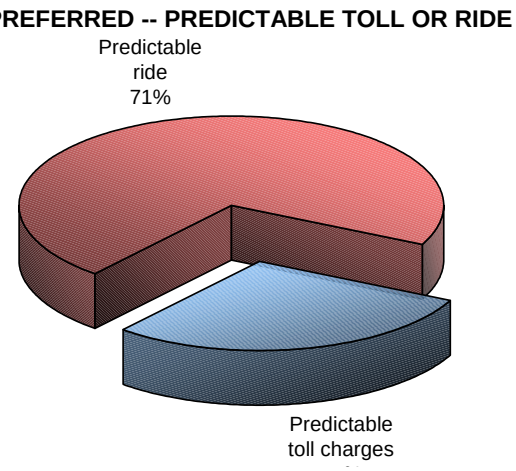

Figure 7 – Example Customer Survey Response

As noted previously, OCTA takes customer feedback on the 91 Express Lanes very seriously and frequently conducts focus groups and customers surveys to gauge opinions and explore possible improvements. Figure 7 displays the results of a recent customer survey which supports implementing dynamic pricing. A large majority of customers preferred a predictable ride or travel time over a predictable toll rate during any specific hour of the day.

Additional customer and community feedback will be received as part of the project monitoring and evaluation process for PMAP[3]. This will be considered along with the travel behavior data collected from the sensor network to establish a complete "after" picture of PMAP[3] deployment. This "after" data can be compared with the "before" condition to assess potential broader socio-economic implications.

5.0 ROLE OF ALTERNATIVE TRANSPORTATION MODES

The fact that the 91 Express Lanes started out as a private toll facility, and was later purchased by OCTA, places the facility in a unique situation when compared with many other value pricing efforts which occur on existing HOV lanes. All private vehicles using the 91 Express Lanes are required to have a registered transponder.

Currently, the 91 Express Lanes support two alternative transportation modes:

- Bus Service - Riverside Transit Agency (RTA) buses operate a commuter service on the 91 Express Lanes without incurring toll charges.
- HOV3+ Free/Discount Program - Since May 19, 2003, carpools of three or more people can drive the 91 Express Lanes on the 91 Freeway for free. The only exception is during eastbound travel on weekdays from 4 p.m. to 6 p.m., where 3+ carpoolers continue to pay the 50% discounted toll charge. This program also applies to customers who drive a motorcycle, use a zero-emission vehicle, or have a DMV issued disable veteran or disable person license plate.

OCTA and the Riverside County Transportation Commission (RCTC) have teamed up to assess multi-modal alternatives for improving travel between Orange County and Riverside County. An 18-month MIS, currently underway, will define short and long-term transportation needs and examine a wide range of options for improving traffic flow between Orange and Riverside counties. Several options currently being considered would have express or commuter bus services operating on the 91 Express Lanes.

Transit and HOVs using the 91 Express Lanes would benefit from the implementation of PMAP[3] due to the enhanced efficiency of dynamic pricing and the improved ability to adjust pricing for maintaining good levels of service on the 91 Express Lanes.

6.0 PROJECT SCHEDULE AND TIMELINE

Significant work efforts have already been completed under the initial assessment and preliminary design phases of PMAP[3]. The most significant work items completed or currently underway include:

- Preliminary Project Plan
- Concept of Operations
- Dynamic Pricing White Paper
- Sensor Network System Specifications

The work already completed allows the PMAP[3] effort to move relatively quickly into simulation, deployment, and testing of a working pilot value pricing project.

The preliminary schedule for PMAP^3 (Deployment Phase) is shown as Figure 8. The schedule is provided relative to the month in which the PMAP^3 deployment phase is initiated. The overall effort is scheduled for 21 months with full operational status following the pilot project if the effort proves successful. OCTA could initiate the deployment phase immediately following notice from FHWA that PMAP^3 has been accepted and funded, completion of the FHWA cooperative agreement, and final approval by the OCTA Board. This schedule should be considered preliminary, and would be formalized should PMAP^3 be accepted into the Value Pricing Pilot Program.

Over the last year, PMAP^3 has become a high profile effort which includes the participation of numerous agencies along the SR-91 Corridor. Both OCTA Executive Management and the intercounty SR-91 Advisory Committee have urged the rapid completion of the initial phases of PMAP^3. To date, PMAP^3 efforts have met the original schedule.

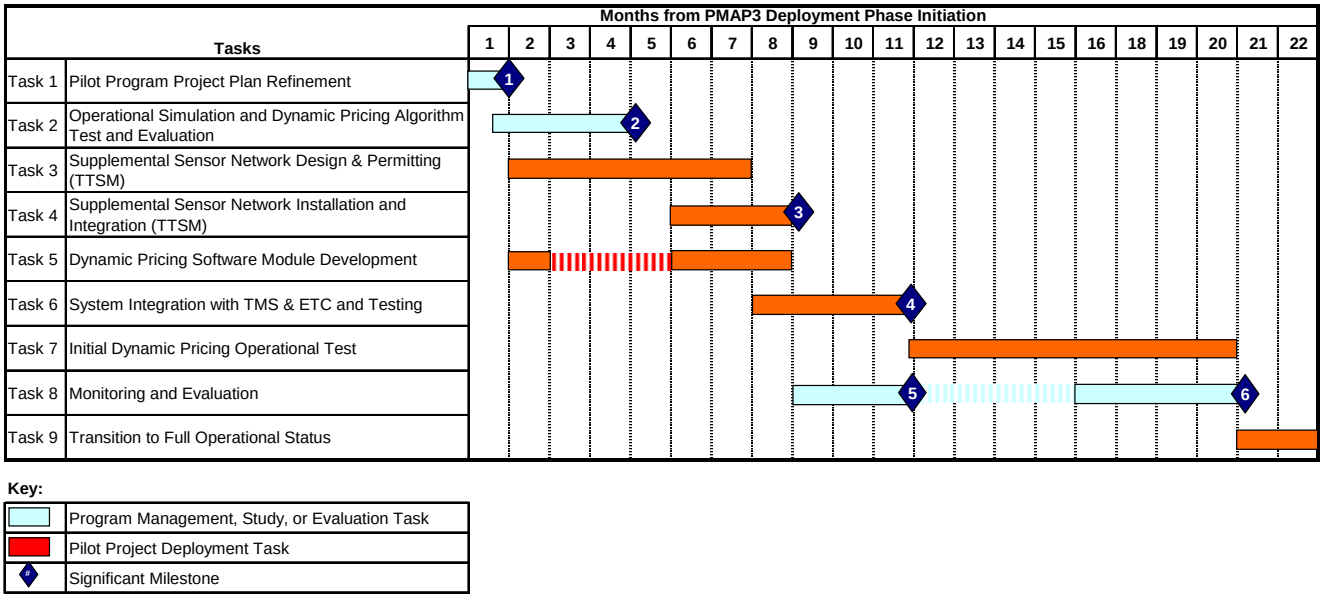

Figure 8 - Preliminary PMAP^3 Deployment Phase Schedule

Major schedule milestones are shown in Figure 8, and include:

1. Detailed/Updated Project Plan Ready,
2. Initial Test Data Collection and Dynamic Pricing Algorithm Testing Complete,
3. All necessary field sensors, communications, and equipment in place to provide the data in support of PMAP^3,
4. PMAP^3 ready for operational testing,
5. "Before" data collection (for monitoring and evaluation) complete, and
6. Evaluations complete (PMAP^3 ready for transition to full operational status assuming a successful outcome).

Should the preliminary schedule shown in Figure 8 not meet with FHWA's expectations for the Value Pricing Pilot Program, OCTA would appreciate the opportunity to discuss any concerns and adjust the schedule accordingly.

7.0 DESCRIPTION OF TASKS AND COSTS

This section provides summary descriptions for each task associated with the PMAP[3] deployment phase, followed by a cost estimate for completing each of the tasks. Should PMAP[3] be accepted into the Value Pricing Pilot Project, OCTA would prepare a more detailed statement of work for the effort and update the current Work Breakdown Structure for the project.

7.1 Task Descriptions

The PMAP[3] deployment phase is comprised of nine tasks.

Task 1 Pilot Program Project Plan Refinement

An initial PMAP[3] project plan was previously prepared and has guided the initial phases of PMAP[3.] This plan includes a Work Breakdown Structure (WBS), overall schedule, and assessment of project risks and potential mitigations. Should PMAP[3] be selected for participation in the Value Pricing Pilot Program, the PMAP[3] project plan will be reviewed and updated to reflect additional task detail, adjusted project schedules, as well as any FHWA requirements for the project.

Task 2 Operational Simulation and Dynamic Pricing Algorithm Test and Evaluation

Prior to moving forward with dynamic pricing in a real operational test on the 91 Express Lanes, the preliminary dynamic pricing algorithm needs to be simulated and tested. The preliminary dynamic pricing algorithm is included in a separate Dynamic Pricing White Paper prepared for PMAP[3]. This algorithm reflects the pricing modes and super states discussed in Section 3.3 of this proposal. Existing data sets are insufficient to test the algorithm for all of the possible pricing modes, in particular real measured travel times are lacking for the SR-91 main lanes and 91 Express Lanes. This task would collect the required data for a particular window in time and then prepare dynamic pricing and traffic micro-simulation models to simulate the effects of the algorithm. This effort will include:

- Initial Operational Dynamic Pricing Algorithm Preparation/Testing – A test version of the dynamic pricing algorithm will be developed to assess the likely system and operational impacts of moving to dynamic pricing. Simulated data will be run through the algorithm and results documented. This test will allow a wide range of operational conditions to be assessed, as well as providing the basis for further development of the dynamic pricing algorithm module (Task 5).
- Travel Time Data Collection – Temporary tag readers will be mounted to extension poles and vehicles at the entrance and exits of the corridor where the 91 Express Lanes are located. Data from these tag readers will provide overall travel times along the main lanes and 91 Express Lanes, which will be combined with data from the ETC to provide an overall measurement of current travel times. Toll tags are estimated to exist on 40-60% of vehicles in the main lanes during peak periods, so tag readers should be sufficient for the needs of the simulation.
- Micro-simulation Preparation – OCTA has staff experienced with Paramics who will prepare a traffic micro-simulation for a portion of the corridor. This staff will work with

the group assessing the dynamic pricing algorithm to include specific software coding to simulate the effects of the dynamic pricing algorithm.

- Dynamic Pricing Testing – Actual travel time and volume data will be used to assess the results of the dynamic pricing algorithm using the micro-simulation and various travel behavior analytical tools that have already been prepared under the initial phases of PMAP^3.
- Dynamic Pricing Algorithm Adjustments – The dynamic pricing algorithm will be adjusted to ensure it is viable and stable enough to move to an operational test.

Results of this task will be documented in a technical memorandum. Also as a part of this task, the Concept of Operations document for PMAP^3 will be updated should the simulations reflect the need to adjust either dynamic pricing operational objectives or the

Task 3 Supplemental Sensor Network Design (TTSM)

In order to effectively support dynamic pricing, it will be necessary to deploy supplemental speed/volume and travel time sensors along the SR-91 corridor. These supplemental sensors are collectively referred to as the Travel Time and Speed Monitoring System (TTSM) in much of the PMAP^3 documentation. This task will provide for the design and permitting of the supplemental sensors and the supporting communications and systems. Designs will utilize existing communications and infrastructure wherever possible. Designs will focus on providing high levels of reliability and data accuracy.

Currently, the sensor network is planned as a combination of additional tag readers (at the entrances and exits of the Express Lanes) and a series of non-intrusive speed/volume sensors. Final locations for field devices and supporting equipment will be determined as a part of this Task. For field devices that will be located in the Caltrans right-of-way, appropriate approvals and right-of-way permits will be obtained.

Task 4 Supplemental Sensor Network Installation and Integration (TTSM)

The supplemental sensor network would be deployed based on the results of Task 3, and integrated with the appropriate TMS and ETC/VES systems located in the TOC. The equipment to be deployed in this task includes:

- Six additional toll tag readers, some of which will require mounting poles or structures.
- Non-intrusive sensors providing speed and volume data for the 91 Express Lanes and adjoining main lanes spaced at approximately ½ mile with concentrated spacing in two choke-point locations.
- Modifications and additional communications equipment required to transmit data from the sensors to either the existing field communications network and/or the TOC.
- Additional database and application servers and associated network equipment to support integration of the sensor data with the traffic management and toll collection systems.
- Supporting commercial off-the-shelf (COTS) software, as well as diagnostics and maintenance tools/equipment.

Integration and performance of the sensor network will be tested at each location and collectively prior to proceeding to Task 7 (operational test).

Task 5 Dynamic Pricing Software Module Development

As shown in the schedule, the first stage of developing the dynamic pricing module will actually occur concurrently with and in support of Task 2. Results of Task 2 will be utilized as the basis for the full development of the dynamic pricing module. In its completed form, the dynamic pricing module will be developed to process the full dynamic pricing algorithm rule set, accounting for both operational and systems considerations, and allowing for appropriate fail-safes. This module will support the four pricing modes identified in Section 3.3 of this proposal. The module will be tested by processing available data collected from Tasks 2 and 4. The dynamic pricing algorithm will allow for evaluation of traffic conditions on both the 91 Express Lanes and adjoining main lanes, with possible toll rate adjustments occurring every six minutes.

This task includes the development platform (servers/software) and COTS necessary to develop the dynamic pricing module. A test plan and procedure will be prepared during this task to fully test the dynamic pricing module, as well as the systems with which it will be linked in Task 6.

Once the algorithm and pricing rule set have displayed sufficient reliability they will be documented in a technical memorandum.

Task 6 System Integration with TMS & ETC and Testing

Once the dynamic pricing module is proven stable it will be relocated to the TOC for integration with the other systems. It has not yet been determined if the dynamic pricing module will be directly imbedded into the traffic management software or maintained as a totally separate application. Including the dynamic pricing module directly in the tolling software has been excluded due to the greater operational risks and the need for the algorithm to process speed and volume data in addition to toll tag data. However, the toll rates will still be maintained in the tolling system, with the dynamic pricing algorithm passing the necessary information to select the appropriate toll rate at that point in time.

This task includes the additional servers and/or software that may be required to provide for the integration of the dynamic pricing module.

The operation of the overall PMAP^3, TMS, and ETC/VES systems will be tested prior to allowing the next phase of testing to proceed.

Task 7 Initial Dynamic Pricing Operational Test

Once task six is complete, the dynamic pricing operational test will occur in three stages:

- Off-line test – Testing of all systems during an off-hours period where toll rates would effectively be set to zero, and resulting toll rates changes would not be displayed to the customers.
- Off-hours test – Active testing of all systems with dynamic pricing active and altering prices during an off-hours period when toll facility volumes are very low. Toll rates and adjustments would be reflected in the information customers see.

- Full operational test – Active testing of all systems with dynamic pricing active 24/7.

All initial tests will include staff monitoring the situation in the TOC, as well as in the field. Detailed operations logs will be kept during all test periods. After each stage of testing, the results will be carefully reviewed and considered prior to proceeding to the next stage. All test results will be reported to OCTA and the Project Development Team, with overviews provided to other stakeholders. Any significant changes to the software or systems will result in the testing returning to the first stage. Operational testing will continue as long as it is fruitful and operations and results are acceptable.

Task 8 Monitoring and Evaluation

For purposes of evaluating the systems and technical performance of PMAP^3, a monitoring and evaluation plan will be prepared and "before" data will be collected once the supplemental sensor network (Task 4) is operational. Before data will be collected and compiled until Task 7 (operational test) commences. Once PMAP^3 enters the full operational test stage (Task 7), "after" data will start to be collected. "After" data will be collected for a minimum of three months (assuming proper system operation). Before and after data will be analyzed and compared to assess the impacts of dynamic pricing.

Once PMAP^3 is operational, surveys and focus groups will be conducted with customers to determine what impacts dynamic pricing has had on their decisions and perceptions of the 91 Express Lanes. Information collected will be compared with previous customer surveys and socio-economic studies.

Section 8 of this proposal provides some additional detail on the monitoring and evaluation approach and measures being suggested by OCTA. An evaluation report will be prepared for submittal to FHWA documenting the findings of the evaluation.

Task 9 Transition to Full Operational Status

Should PMAP^3 prove operational successful and meet the objectives outlined in Table 2 of this proposal, it may be permanently adopted for operations on the 91 Express Lanes. The final determination regarding full and continued operations status of PMAP^3 will be made by the OCTA Board.

7.2 Cost Estimate for PMAP[3] Deployment

OCTA has prepared a cost estimate for the PMAP[3] deployment phase effort which is shown in Table 3. Table 3 also displays the anticipated breakdown between Federal funds from the Value Pricing Pilot Program and OCTA funds.

Table 3 – Cost Estimate for PMAP[3] Deployment Phase

Task	Funding Source Breakdown		Totals
	Federal (VPPP)[*1]	*OCTA Funds*[*2]	
Task 1 – Pilot Program Project Plan Refinement	$35,000		$35,000
Task 2 – Operational Simulation and Dynamic Pricing Algorithm Test and Evaluation	$105,000	$25,000	$130,000
Task 3 – Supplemental Sensor Network Design and Permitting (TTSM)	$100,000	$20,000	$120,000
Task 4 – Supplemental Sensor Network Installation and Integration (TTSM)	$350,000	$150,000	$500,000
Task 5 – Dynamic Pricing Software Module Development	$100,000	$50,000	$150,000
Task 6 – System Integration with Traffic Management and Electronic Toll Collection Systems	$150,000	$100,000	$250,000
Task 7 – Initial Dynamic Pricing Operational Test	$200,000		$200,000
Task 8 – Monitoring and Evaluation	$150,000		$150,000
Task 9 – Transition to Full Operations		$50,000	$50,000
Subtotals	**$1,190,000**	**$395,000**	
PMAP[3] (Deployment Phase) Total Cost Estimate			**$1,585,000**

Notes:
**1 Funds requested from the FHWA Value Pricing Pilot Program.*
**2 OCTA funds from toll revenues, pending OCTA Board approval.*

As shown in Table 3, the total estimated cost for the PMAP[3] deployment phase is $1,585,000 with $395,000 proposed from OCTA toll revenue funds and $1,190,000 in federal funds from the Value Pricing Pilot Program. The overall resulting OCTA match to the federal funds is approximately 25%.

8.0 PLANS FOR MONITORING AND EVALUATION

As part of the initial PMAP[3] project efforts, an evaluation technical memorandum will be prepared to outline an evaluation process and identify final measures of effectiveness. This document will provide the basis for evaluating PMAP[3] pilot deployment efforts. At this point, OCTA can provide some information on the plans for evaluation based on current practices and work efforts completed to date. The PMAP[3] evaluation will look at:

- **Technical Performance** – A portion of the monitoring and evaluation effort will be dedicated to reviewing the technical performance of PMAP[3] in comparison with existing operations.
    - Systems – Do systems provide very high levels of reliability in terms of:
        - Accurately measuring and recording traffic conditions on the 91 Express Lanes and adjoining main lanes;
        - Reverting to default mode automatically in the event of system failures or manual intervention;
        - Effectively adjusting toll rates at the required regular intervals; and
        - Properly displaying accurate toll rates?
    - Operations – How are operations impacted in terms of:
        - Safe and reliable operations on the 91 Express Lanes;
        - Safe and reliable operations on the adjoining main lanes;
        - Ease or difficulty of enforcement; and
        - Demands on TOC operators?
    - Travel Times/Speeds – What impacts does PMAP[3] and dynamic pricing have in terms of:
        - Providing more reliable travel times for customers;
        - Improving travel times on the 91 Express Lanes and adjoining main lanes; and
        - Improving speeds on the 91 Express Lanes and adjoining main lanes?
    - Usage – How does PMAP[3] impact the number of customers who use the 91 Express Lanes on a regular basis, and does it help attract new customers? Does it impact the number of violations?
    - Tolls – How does the implementation of PMAP[3] impact toll rates by time of day and under traffic conditions? How does it impact the median and mean toll rates experienced by 91 Express Lane customers?
- **Customer Perceptions** – A portion of the evaluation will focus on customer reactions and views which are extremely important to OCTA. Techniques will focus on surveys of existing customers and focus groups, consistent with OCTA's current practices.
- **Traffic/Revenue Forecasts** – Evaluating the near- and long-term impacts to traffic volume and revenues for the 91 Express Lanes is critical to OCTA. For PMAP[3] to be successful it must meet both the operational and policy goals set for it while remaining largely revenue neutral under existing and forecast conditions.

OCTA continuously monitors customer feedback and system performance, and has well established procedures and support mechanisms to conduct evaluations. Should FHWA desire to use an outside evaluator (in addition to OCTA's own evaluation) for the Value Pricing Pilot Program, OCTA would be pleased to work with whomever FHWA may select in evaluating the outcome of PMAP[3].

9.0 FINANCE AND REVENUE PLAN

OCTA is requesting $1.19 million in federal funds from the Value Pricing Pilot Program; matched at 25% with $395,000 in OCTA toll revenues (pending final OCTA Board approval) for a total estimated cost for the PMAP^3 deployment phase of $1.585 million.

The 91 Express Lanes have a well established history as a self-supporting toll facility. The development of PMAP^3 efforts to date have focused on moving from value pricing to dynamic pricing without significant negative or positive impacts to revenue. The desired solution is to enhance efficiency and throughput of the SR-91 Corridor and 91 Express Lanes while largely maintaining revenue neutrality. Revenues from the 91 Express Lanes are currently used to cover operational costs, service the bonds used to purchase the facility, and fund operational improvements along the corridor.

Receipt of federal funds would allow OCTA to proceed with PMAP^3 testing and deployment efforts which are not essential to the direct and continued operation of the 91 Express Lanes. Should FHWA accept and fund PMAP^3 for participation in the Value Pricing Pilot Program, OCTA has proposed to provide matching funds from toll revenues (pending final OCTA Board approval). The matching funds represent a portion of a larger TOC and TMS upgrade that OCTA has planned and programmed for the 91 Express Lanes. This portion of the upgrade is directly applicable to PMAP^3, as it is provides systems upgrades essential in order to move to a dynamic pricing approach.

Should initial testing and/or operational deployment of PMAP^3 risk to: adversely impact toll revenues in a significant fashion; or generate any significant adverse customer reaction, PMAP^3 would be suspended. OCTA feels that even if this were to occur that the results of the pilot project effort would still provide very useful information for FHWA's Value Pricing Pilot Program.

The 91 Express Lanes are in a somewhat unique position where continued operation of PMAP^3 is relatively easily funded through on-going toll revenues should it prove successful in achieving its objectives (as shown in Table 1). The incremental on-going operations and maintenance costs of PMAP^3 are anticipated to be relatively low, as it would not significantly increase staffing requirements. Should PMAP^3 prove successful, the continued operation and operating costs of PMAP^3 would be incorporated into the normal 91 Express Lanes operations, finance, and revenue plans.

10.0 PLANS FOR INVOLVING KEY AFFECTED PARTIES

As the PMAP^3 effort has already been underway for several months, all affected parties have already been involved within a well established institutional structure. This structure is displayed in Figure 9.

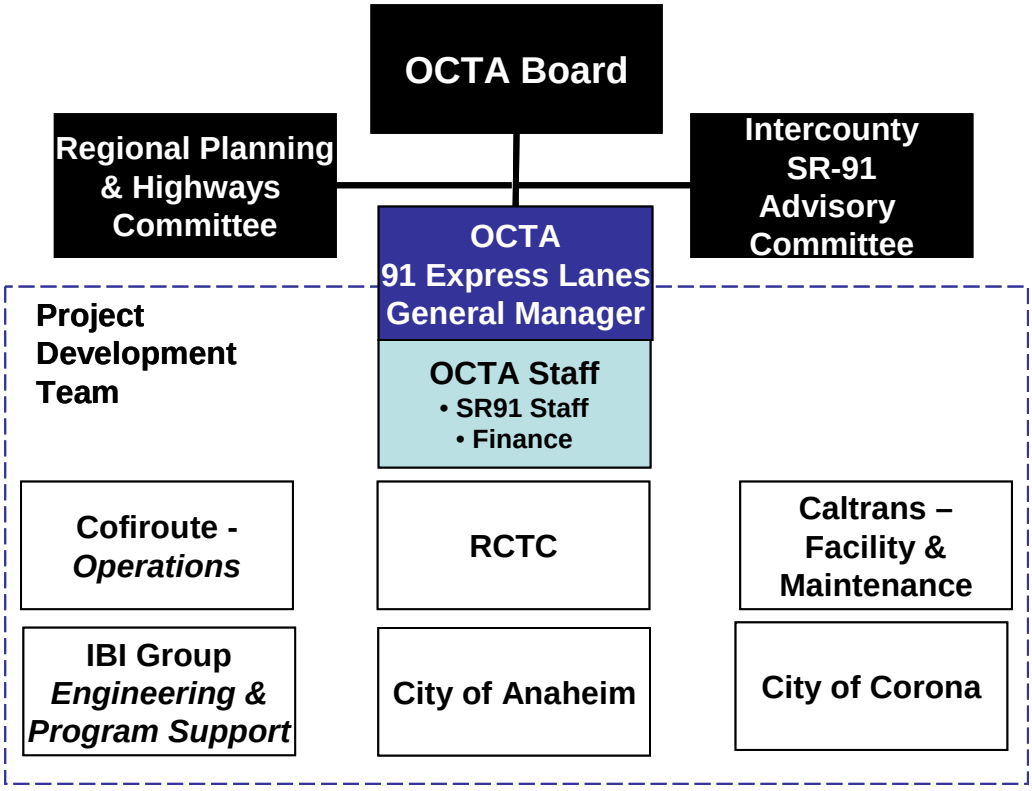

Figure 9 - Established PMAP[3] Organization

The PMAP[3] stakeholder structure includes:

- **Project Development Team** – This is the technical team responsible for providing input on deliverables and continued guidance as the PMAP[3] project moves forward. This group meets monthly and consists of: OCTA, Caltrans, Riverside County Transportation Commission (RCTC), City of Anaheim, City of Corona, Cofiroute (contracted facility operator), and IBI Group (contracted systems support/engineering).
- **OCTA Staff** – OCTA has dedicated staff responsible for oversight and management of the 91 Express Lanes operations and contracts. These staff are also the responsible staff on PMAP[3].
- **Intercounty SR-91 Advisory Committee** – A standing Orange and Riverside intercounty committee that is comprised of numerous elected officials and agency executive management from the SR-91 corridor, the Advisory Committee has received several presentations on PMAP[3], and has provided valued input for project development.
- **Regional Planning & Highways Committee (RP&H)** – As the established group for reviewing and assessing transportation projects and their impacts in Orange County, the PMAP[3] project and status are consistently reported to RP&H in order to receive broader stakeholder input.
- **OCTA Board** - An 18-member Board of Directors governs OCTA. The Board consists of 5 county supervisors, 10 city members, 2 public members and the Director of the Department of Transportation District 12 (Caltrans) as a non-voting member.

- **Customers** – Customers are viewed as the most important stakeholders in both the operation of the 91 Express Lanes, as well as PMAP[3]. As noted in Section 8.0, OCTA is very conscious of customer perceptions, and will both provide information to (via customer newsletters, web pages, and public announcements) and seek input from (via customer surveys and focus groups) customers.

PMAP[3] information is usually presented to the RP&H and/or Advisory Committee prior to proceeding to the OCTA Board. All final policy and key decisions for the 91 Express Lanes are made by the OCTA Board. This stakeholder involvement structure is well established and would continue to be utilized for the PMAP[3] deployment phases.

11.0 LEGAL AND ADMINISTRATIVE REQUIREMENTS

OCTA deals with federal, state, and local legal and administrative requirements on a daily basis for multi-million dollar capital infrastructure, operations, and planning projects. OCTA is very familiar with FHWA and FTA policies, requirements, and procedures, and has dedicated staff and departments experienced in ensuring these requirements are met. In addition, OCTA is the owner and operator of the 91 Express Lanes, and has ensured that the PMAP[3] project meets the requirements for the 91 Express Lanes.

FHWA would need to approve this proposal and allow the proposed project to be enforced in accordance with the requirements of the VPPP. Cooperative agreements would be signed between FHWA, Caltrans and OCTA. The OCTA Board of Directors would need to approve any cooperative agreements that would be entered into between OCTA and FHWA, Caltrans and any other party as a result of the VPPP.

12.0 SIGNATORIES TO FHWA COOPERATIVE AGREEMENT

The following parties are proposed as being signatories of the cooperative agreement with FHWA:

- Orange County Transportation Authority (OCTA); and
- Caltrans, District 12.

It should be noted that OCTA is both Orange County's primary transportation agency, as well as the owner and operator of the 91 Express Lanes, therefore no separate toll entity is involved.