Los Angeles Congestion Reduction Demonstration (Metro ExpressLanes) Program

National Evaluation: Environmental Data Test Plan

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16. Abstract

This report presents the Environmental Data Test Plan for the national evaluation of the Los Angeles (LA) Congestion Reduction Demonstration (Metro ExpressLanes) under the United States Department of Transportation (U.S. DOT) Congestion Reduction Demonstration (CRD) Program. The Los Angeles CRD projects focus on reducing traffic congestion by employing strategies consisting of combinations of tolling, transit, telecommuting/travel demand management (TDM), and technology, also known as the 4Ts. Tolling (pricing) strategies include converting high occupancy vehicle (HOV) lanes on the two freeway corridors to variably-priced high occupancy toll (HOT) lanes, adding a second HOT lane to portions of one corridor, and implementation of a downtown LA intelligent parking management system featuring demand-based pricing and real-time parking availability information. Transit improvements include increased bus service, transit station security improvements, expansion of two transit stations, creation of an El Monte Busway/Union Station bus service connection, and the expansion of downtown LA transit signal priority. TDM strategies aim to establish 100 new registered vanpools. This Environmental Data Test Plan is one of ten test plans being developed. The other nine test plans consist of the following: traffic; exogenous factors; transit systems; surveys, interviews and workshops; ridesharing; safety; tolling; content analysis; and cost-benefit. Each test plan is based on the LA CRD National Evaluation Plan. This test plan describes the sources, availability, and possible risks associated with the data. The methods for analyzing the tolling data are discussed. The schedule and responsibility for collecting, analyzing, and reporting the environmental data are also presented.

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LIST OF ABBREVIATIONS

4Ts	Tolling, Transit, Telecommuting, and Technology
Caltrans	California Department of Transportation
CHP	California Highway Patrol
CO_2	Carbon dioxide
CRD	Congestion Reduction Demonstration
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HOT	High occupancy toll
HOV	High occupancy vehicle
I-10	Interstate 10 (El Monte Busway between Alameda St and I-605)
I-110	Interstate 110 (Harbor Transitway between Adams Blvd and Harbor Gateway Transit Center)
IPM	Intelligent Parking Management
LA	Los Angeles
LA CRD	Los Angeles Congestion Reduction Demonstration
LADOT	Los Angeles Department of Transportation
Metro	Los Angeles County Metropolitan Transportation Authority
Metrolink	Southern California Regional Rail Authority
MOE	Measure of effectiveness
NO_x	Nitrogen oxide (precursor to ozone)
$PM_{2.5}$	Particulate matter that is 2.5 micrometers in diameter and smaller
PM_{10}	Particulate matter that is 10 micrometers in diameter and smaller
SBCCOG	South Bay Cities Council of Governments
SCAG	Southern California Association of Governments
SGVCOG	San Gabriel Valley Council of Governments
TDM	Travel demand management
UPA	Urban Partnership Agreement
U.S. DOT	United States Department of Transportation
VOC	Volatile organic compound

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1.0 INTRODUCTION

This report presents the test plan for collecting and analyzing environmental data for the national evaluation of the Los Angeles (LA) Congestion Reduction Demonstration (Metro ExpressLanes) Program under the United States Department of Transportation (U.S. DOT) Congestion Reduction Demonstration (CRD) program. The LA CRD (Metro ExpressLanes) is one of several large field deployments around the United States that are receiving U.S. DOT funding and which are intended to demonstrate congestion pricing and supporting strategies. The LA CRD (Metro ExpressLanes) Program national evaluation will address the four primary U.S. DOT evaluation questions shown in Table 1-1.

Table 1-1. U.S. DOT National Evaluation "Objective Questions"

Objective Question #1	How much was congestion reduced in the area impacted by the implementation of the tolling, transit, technology, and telecommuting strategies? It is anticipated that congestion reduction could be measured by one of the following measures, and will vary by site and implementation strategy: • reductions in vehicle trips made during peak/congested periods; • reductions in travel times during peak/congested periods; • reductions in congestion delay during peak/congested periods; and • reductions in the duration of congested periods.
Objective Question #2	What are the associated impacts of implementing the congestion reduction strategies? It is anticipated that impacts will vary by site and that the following measures may be used: • increases in facility throughput during peak/congested periods; • increases in transit ridership during peak/congested periods; • modal shifts to transit and carpools/vanpools; • traveler behavior change (e.g., shifts in time of travel, mode, route, destination, or forgoing trips); • operational impacts on parallel systems/routes; • equity impacts; • environmental impacts; • impacts on goods movement; and • effects on businesses.
Objective Question #3	What are the non-technical success factors with respect to the impacts of outreach, political and community support, and institutional arrangements implemented to manage and guide the implementation?
Objective Question #4	What are the overall costs and benefits of the deployed set of strategies?

The questions shown in Table 1-1 will be addressed by carrying out the following 11 "evaluation analyses" described in the LA CRD (Metro ExpressLanes) Program National Evaluation Plan[1]: tolling, technology, transit, travel demand management (TDM), congestion, safety, equity, environment, business impacts, non-technical success factors, and cost benefit. Each of these 11 analyses relies upon various evaluation measures of effectiveness.

[1] Los Angeles County Congestion Reduction Demonstration National Evaluation Plan, January 13, 2010, U.S. DOT.

"Test plans" are the evaluation planning documents that describe how specific data will be collected and processed to yield the evaluation measures of effectiveness required for the various analyses. Whereas evaluation analyses are categorized according to related evaluation questions or types of impacts, for example all equity-related impacts are addressed in the equity analysis, test plans are categorized according to common data types or sources. For example, the "Traffic System Data Test Plan" collects and processes all of the traffic data required for the national evaluation. There are a total of ten test plans for the LA CRD (Metro ExpressLanes) Program national evaluation. In addition to this Environmental Data Test Plan, there are test plans focusing on the following types of data: traffic; transit systems; exogenous factors; ridesharing; safety; tolling; content analysis; surveys, interviews, and workshops; and cost benefit.

The relationship between test plans and evaluation analyses is discussed in Section 1.2. In short, analyses describe the evaluation questions and hypotheses to be investigated and the test plans describe how the data and measures of effectiveness needed to support the evaluation will be collected and processed. Most test plans collect data and provide measures of effectiveness that will be used in multiple analyses and most analyses rely upon data and measures developed through several different test plans.

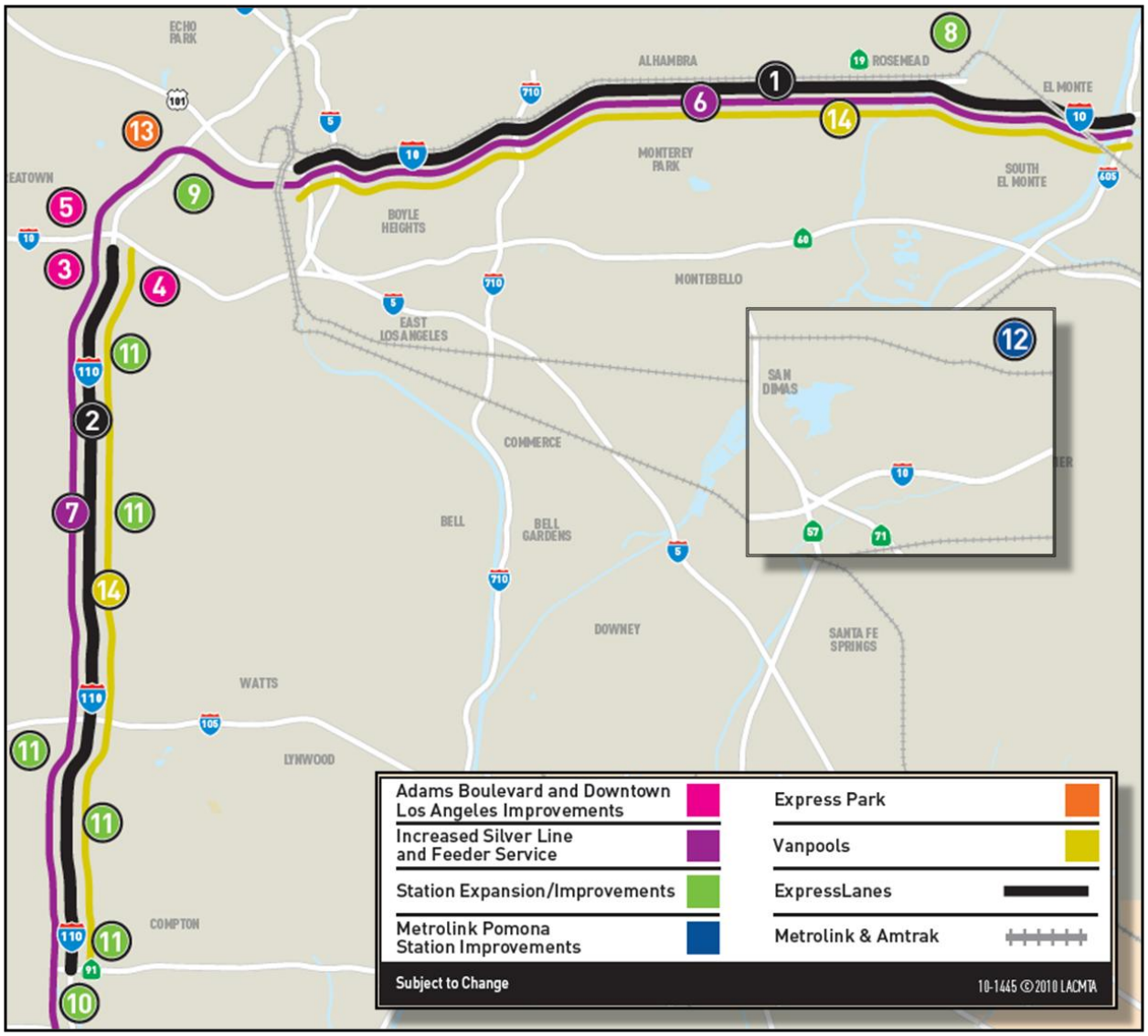
The remainder of this introduction chapter describes the LA CRD (Metro ExpressLanes) Program deployments and elaborates on the relationship between test plans and evaluation analyses. The remainder of the report is divided into three sections. Chapter 2.0 presents the data sources, data availability, and risks associated with the data collected through this test plan. Chapter 3.0 discusses how all of the tolling data will be analyzed and used in the national evaluation. Chapter 4.0 presents the schedule and responsibilities for collecting and analyzing the tolling data.

1.1 The LA CRD (Metro ExpressLanes) Program Projects

The LA CRD (Metro ExpressLanes) Program was selected by the U.S. DOT as an Urban Partner to implement projects aimed at reducing congestion based on four complementary strategies known as the 4Ts: Tolling, Transit, Telecommuting/TDM, and Technology. Under contract to the U.S. DOT, a national evaluation team led by Battelle is assessing the impacts of the projects in a comprehensive and systematic manner in Los Angeles (LA) County and other sites. The national evaluation will generate information and produce technology transfer materials to support deployment of the strategies in other metropolitan areas. The national evaluation will also generate findings for use in future Federal policy and program development related to mobility, congestion, and facility pricing.

The LA CRD (Metro ExpressLanes) Program effort is led by the Los Angeles County Metropolitan Transportation Authority (Metro). The CRD projects are being implemented with the assistance of a number of supporting agencies especially the California Department of Transportation (Caltrans); and the Los Angeles Department of Transportation (LADOT). Other participating agencies include the Southern California Association of Governments (SCAG); the San Gabriel Valley Council of Governments (SGVCOG); the South Bay Cities Council of Governments (SBCCOG); the Southern California Regional Rail Authority (Metrolink); Foothill Transit; the California Highway Patrol (CHP); and the Los Angeles County Sheriff's Department. The LA CRD (Metro ExpressLanes) Program projects are intended to reduce

congestion, promote throughput, and enhance mobility in the Interstate-10 (I-10) and Interstate-110 (I-110) corridors, and in downtown Los Angeles. Figure 1-1 shows the location of the LA CRD (Metro ExpressLanes) Program projects and Figure 1-2 provides short summaries of the numbered projects on Figure 1-1.



Derived from Metro ExpressLanes project map

Note: See Figure 1-2 for the explanation of each numbered project on this map.

Figure 1-1. LA CRD (Metro ExpressLanes) Program Project Locations

Derived from Metro ExpressLanes project map.

1 **EXPRESSLANES ON I-10**

This project will convert existing HOV lanes on the I-10 from Alameda Street/Union Station to I-605 into ExpressLanes (44 lane miles). The budget will cover the toll technology, toll infrastructure and operational improvements required to complete the conversion. This project will also provide additional ExpressLanes capacity on the El Monte Busway between I-710 and I-605 through re-striping and buffer changes. No general purpose lanes are taken away to create the second ExpressLane between I-710 and I-605.

2 **EXPRESSLANES ON I-110**

This project will convert existing HOV lanes on the I-110 from 182nd Street/Artesia Transit Center to Adams Boulevard into ExpressLanes (38 lane miles). The budget will cover the toll technology, toll infrastructure and operational improvements required to complete the conversion.

ExpressLanes is a one-year demonstration project. Buses, motorcycles, vanpools, and carpools that currently use HOV lanes will not be charged a toll. General purpose lanes will continue to remain toll-free. The following projects will provide additional access and capacity to the I-10 and I-110 ExpressLanes, to encourage movement of more people rather than more vehicles.

ADAMS BOULEVARD AND DOWNTOWN LOS ANGELES IMPROVEMENTS

3 **I-110 ADAMS/FIGUEROA FLYOVER STUDY**

The Adams/Figueroa Flyover Study will investigate how the construction of a new structure – connecting the I-110 northbound HOV lane off-ramp directly to Figueroa Street – could improve traffic flow at the end of the I-110 HOV lane.

4 **ADAMS BOULEVARD STREET WIDENING**

Adams Boulevard will be widened between the Harbor Freeway off-ramp and Flower Street – adding an additional westbound right-turn-only lane to the HOV bypass connecting to Figueroa Street. Re-striping will also add one extra lane to the HOV off-ramp approaching Adams Boulevard to increase capacity.

5 **TRANSIT SIGNAL PRIORITY IN LOS ANGELES**

This project will install bus-signal priority technology on Figueroa Street between Wilshire Boulevard and Adams Boulevard (15 signals), and Flower Street between Wilshire Boulevard and Olympic Boulevard (5 signals) to enhance transit operations. It will also extend the existing AM peak-period northbound bus-only lane on Figueroa Street between 23rd Street and 4th Street to cover the PM peak-period.

INCREASED SILVER LINE AND FEEDER SERVICE

6 **NEW BUSES FOR THE I-10 EL MONTE BUSWAY CORRIDOR**

Before adding ExpressLanes to the corridor, Metro and its transit partner – Foothill Transit – will purchase 30 new buses and increase Silver Line and feeder service on the I-10 El Monte Busway, with a goal of providing service every three to seven minutes during rush hour.

7 **NEW BUSES FOR I-110 HARBOR TRANSITWAY CORRIDOR**

Before adding ExpressLanes to the corridor, Metro and its transit partners – Torrance Transit and Gardena Transit – will purchase 29 new buses to improve Silver Line and feeder service on the I-110 Transitway, with a goal of providing service every three to seven minutes during rush hour.

STATION EXPANSION/IMPROVEMENTS

8 **EL MONTE TRANSIT STATION EXPANSION**

The El Monte Station is the eastern terminus of the El Monte Busway, and is currently the busiest bus terminal west of Chicago. Given that the El Monte Station will now also be the eastern terminus of the ExpressLanes, expansion of the terminal will be required to accommodate additional high-capacity buses, passenger parking and bike lockers.

9 **PATSAOURAS PLAZA/UNION STATION CONNECTION**

A new Union Station stop will be created for the El Monte Busway, allowing direct access to the station's Patsaouras Transit Plaza. This will eliminate the long walks, operational delays and insufficient lighting and information displays passengers currently have to contend with when transferring at Alameda Street to Metro's Red and Gold lines, Metrolink and Amtrak.

10 **IMPROVED ARTESIA TRANSIT CENTER SECURITY**

Improvements at the largest transit center on the I-110 Harbor Transitway include bike lockers to promote non-motorized access and a law enforcement substation to assist with station security.

11 **I-110 HARBOR TRANSITWAY PARK & RIDE AND TRANSIT STATION IMPROVEMENTS**

Improvements to these facilities will include enhanced signage, lighting and security. Other benefits to customers include new bus stops under Slauson and Manchester stations for Lines 108/115, and improved signage and security for existing Harbor Transitway Park and Ride lots at Slauson, Manchester, Harbor Green Line, Rosecrans, Artesia, Carson, PCH and Harbor/Beacon in San Pedro.

METROLINK POMONA STATION IMPROVEMENTS

12 **ADDITIONAL COMMUTER RAIL CAPACITY**

This station on Metrolink's San Bernardino Line will undergo several improvements, including the addition of 143 new parking spaces and the expansion of platforms to accommodate longer eight-car trains.

EXPRESS PARK

13 **DOWNTOWN PARKING MANAGEMENT**

This project will use new parking technology to provide motorists alternative payment options and real-time parking availability information for nearly 13,000 on-street and off-street parking spaces in Downtown Los Angeles. The information will aid motorists in understanding their parking options and will guide them to available parking spaces – eliminating the need to search for parking and reducing traffic congestion.

New parking meters will be installed at approximately 5,500 on-street metered parking spaces in the downtown area. These meters will be capable of charging motorists demand-based parking rates – which change depending on the time of day and traffic congestion levels. They will also provide alternative payments options, allowing motorists to pay for parking using their credit card or cell phone and to receive a text message when their paid parking time is about to expire.

VANPOOLS

14 **I-10/I-110 COMMUNITY-BASED VANPOOL FORMATION**

This program will provide vanpool formation services to any community where ExpressLanes are implemented. This includes a dedicated vanpool representative that will actively train community groups to form vanpools and provide support to ensure that vanpools are created and retained.

In addition to receiving the incentive of free access to the new ExpressLanes, vanpoolers along those corridors will also be eligible for vanpool start-up assistance, which may cover the cost of driver and back-up driver training and exams, as well as special training on how best to keep existing vanpools together.

Figure 1-2. LA CRD (Metro ExpressLanes) Program Project Descriptions

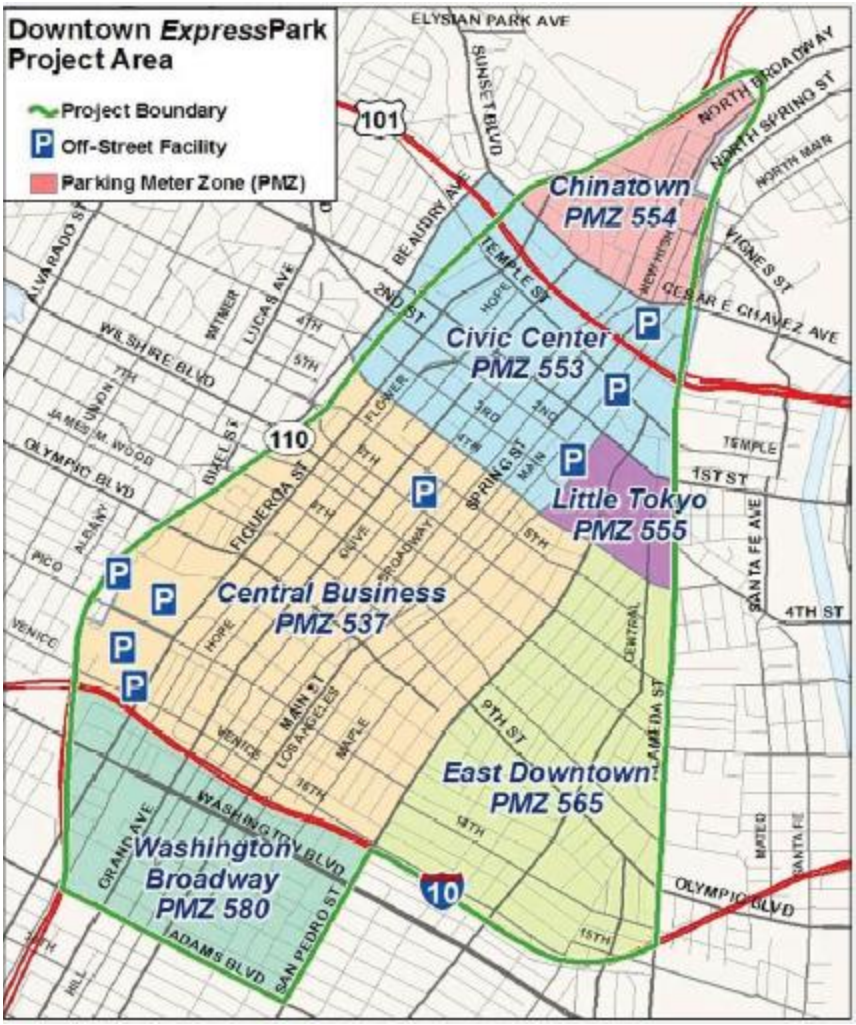
The U.S. DOT is allocating $210.6 million in Federal grant funding for the LA CRD projects, drawn from the Federal Transit Administration (FTA) 5309 Bus and Bus Facilities Program. The LA CRD projects consist of the following:

- **Transit Improvements** to increase the frequency of Metro bus rapid transit service through the acquisition of 59 new clean fuel expansion buses (30 buses in the I-10 El Monte Busway corridor and 29 buses in the I-110 Harbor Transitway corridor) and increased service: to one bus every seven minutes along the I-10 corridor and to one bus every ten minutes along the I-110 corridor. Various security upgrades will be made to the Harbor Gateway Transit Center (better lighting, new security cameras, bicycle lockers and a new L.A. County Sheriff's substation). Expansion of the El Monte Transit Center includes reconstruction of the existing transit passenger terminal, additional surface parking, and a new administration facility. A new El Monte Busway stop will be created at Union Station that will allow for direct pedestrian access to Union Station's Patsaouras Transit Plaza and thus promote transfers to/from the El Monte Busway and other transit services. Expansion of the Pomona (North) Metrolink station includes 143 new parking spaces and extended platforms to accommodate additional rail cars for the San Bernadino Line. Improvements to Harbor Transitway Park-and-Ride lots and Transit Stations include enhanced signage, lighting, and closed-circuit television cameras for existing lots at Slauson, Manchester, Harbor Green Line, Rosecrans, and Harbor Gatway as well as the relocation of bus stops for Lines 108 and 115 to the Slauson and Manchester Transitway stations. The 37th Street Station will also be fitted with translucent and architectural sound attenuation panels to reduce noise levels for waiting customers on the Harbor Transitway. Implementation of transit signal priority technology on Figueroa Street (15 signals between Wilshire Boulevard and Adams Boulevard) and Flower Street (5 signals between Wilshire Boulevard and Olympic Boulevard) in downtown Los Angeles. Lastly, to facilitate HOT traffic movement where the I-110 freeway enters downtown Los Angeles, Adams Boulevard will be widened and the Adams Boulevard off ramp will be restriped, both providing an additional lane of high occupancy vehicle (HOV) capacity.
- **High Occupancy Toll (HOT) Lanes** ("ExpressLanes") to expand freeway capacity by permitting toll-paying, single occupancy vehicles or those that do not meet the carpool occupancy requirement to use slack, HOT lane capacity on the I-10 and I-110 freeways. ExpressLanes will be created by converting existing HOV lanes into HOT lanes along the I-10 (from I-605 to Alameda Street) and along the I-110 (from 182nd Street to Adams Boulevard). In addition, a second HOT lane will be created (via restriping; no loss of general purpose lanes will occur) on I-10 from I-605 to I-710 where there is no slack HOV lane capacity during peak periods. All vehicles will pay to use the HOT lanes with the exception of transit vehicles, motorcycles and multiple-occupant private vehicles (three or more occupants on I-10 during peak hours, two or more all other times; two or more occupants on I-110). All tolls will be collected electronically, requiring all vehicles entering HOT lanes to be equipped with a transponder. Vehicles satisfying the ExpressLane occupancy requirements and therefore eligible to use the lane free of charge will "self declare" by setting a switch on their transponders. ExpressLane enforcement will be carried out manually through on-site law enforcement observation. Tolls will range from a minimum $0.25 per mile to a maximum $1.40 per mile depending on

congestion levels. When travel speeds in the HOT lanes fall below 45 mph for more than ten minutes, the ExpressLanes have reached capacity. At this point, the lanes will revert to HOV lanes and vehicles that do not meet the carpool occupancy requirements will not be permitted to "buy" their way into the lanes. Low income commuters[2] will receive cost reductions through the Equity Account Discount, consisting of a $25 discount for toll account set-up and waiver of the $3 non-usage maintenance fee.

- **Intelligent Parking Management (IPM)** ("LA ExpressPark") consists of a variable, demand-based parking pricing system coupled with a parking guidance system that will include real-time parking availability information. The IPM is intended to reduce traffic congestion, reduce air pollution, and improve transit efficiency by reducing parking search times by achieving 10 to 30 percent parking availability for on-street parking. The LA ExpressPark system will cover approximately 13,500 City of Los Angeles-owned or operated parking spaces (about 6,000 on-street, metered spaces and about 7,500 off-street spaces in an area of downtown Los Angeles bounded by the I-10 and I-110 freeways, Alameda Street and Adams Boulevard. The project area is shown in Figure 1-3. LA ExpressPark meter capabilities include demand-based parking rates based on time of day and length of stay; alternate payment options (coins, credit card, smart phone, cell phone); and increased convenience (text messages when paid parking time is about to expire). Vehicle sensors placed in the on-street metered parking spaces provide real-time occupancy and parking duration information. Parking conditions and availability in off-street parking locations will be determined using vehicle sensors, cordon counting systems and/or advanced revenue control systems. The parking guidance component of the IPM will provide information via a limited number of on-street dynamic message signs when not in use for active traffic management, an Internet web site, mobile phones using Metro's 511 interactive voice response system, smart phones and, pending industry support, in-vehicle navigation systems.
- **Ridesharing Promotion (travel demand management)** to increase the number of registered vanpools (with a goal of 100 new vanpools on the I-10 and I-110 corridors), and major employer-based ridesharing through the use of promotional methods including subsidies to travelers and vanpool operators and promotional outreach to major employers. In addition, a Metro ExpressLanes Carpool Loyalty Program is being developed which will incentivize vanpool trips by offering monthly drawings for gift cards on each corridor. Vanpools will be automatically entered into the drawing every time they use the Metro ExpressLanes and the toll system detects their FasTrak at the 3+ setting.

[2] The Equity Account Discount defines low income commuters as Los Angeles residents with an annual household income (family of 3) of $35,000 or less.



Derived from "ExpressPark Intelligent Parking Management: Downtown" Los Angeles Department of Transportation Pamphlet http://ladot.lacity.org/pdf/PDF217.pdf

Figure 1-3. LA ExpressPark Project Area

Schedule for the LA CRD (Metro ExpressLanes) Program Projects. As shown in Figure 1-4, the LA CRD (Metro ExpressLanes) Program projects will become operational in a phased manner. Tolling on I-110 is scheduled to begin in October 2012, and tolling on I-10—the last project to be completed—is scheduled to begin in February 2013. Most of the LA CRD (Metro ExpressLanes) Program projects will be coming on line in advance of I-110 and I-10 tolling. One project will come on line after tolling begins on the I-10.

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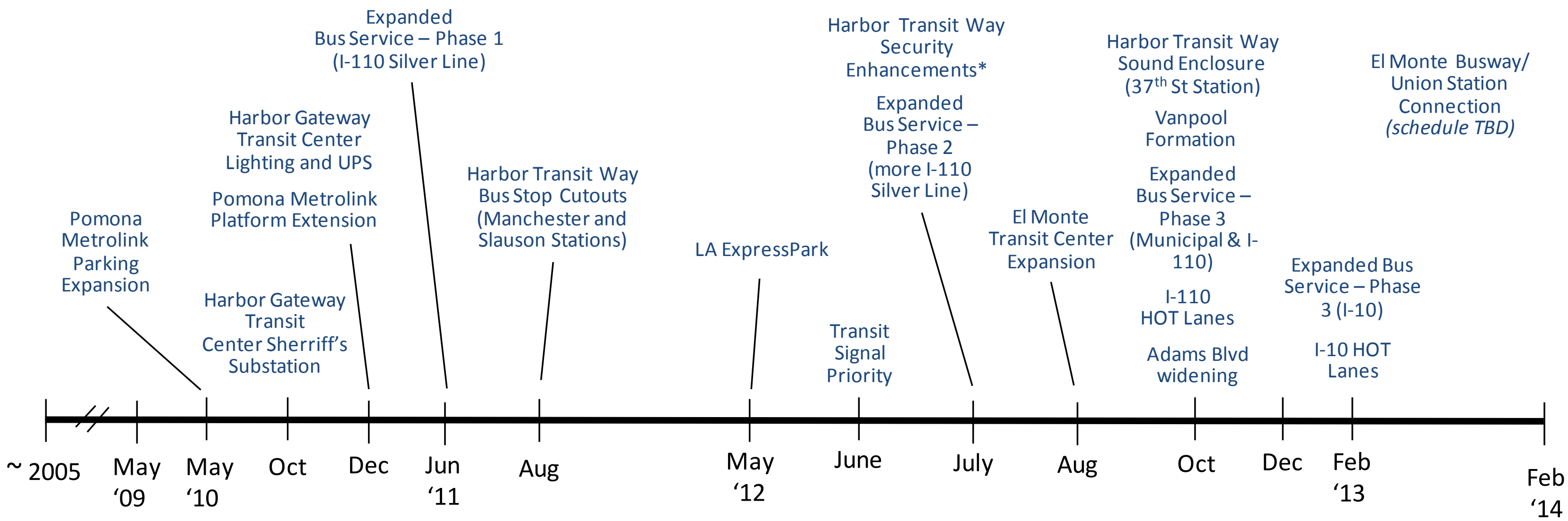
Based on information provided by Metro; July 2012.



**Stations: Slauson, Manchester, Harbor Green Line, Rosecrans, Harbor Gateway*

Figure 1-4. LA CRD (Metro ExpressLanes) Program Project Completion ("Go Live") Schedule

1.2 Los Angeles National Evaluation Plan and the Use of Environmental Data

Table 1-2 shows which of the various LA CRD (Metro ExpressLanes) Program test plans will contribute data to each of the evaluation analyses. The "flow" between test plans is "one way" in the sense that test plans feed data and measures to the analyses rather than the reverse. The solid circles show where data from a given test plan constitutes a major input to an analysis; the open circles show where data from a given test plan constitutes a supporting input to an analysis. As shown in Table 1-2, the Environmental Data Test Plan provides major input to the environmental analysis and supporting input to the equity and cost benefit analyses.

Within a test plan, data are categorized by type into various "data elements." Table 1-3 includes a summary of the environmental data elements, the measures of effectiveness (MOEs) that the data elements will be used to construct, and the hypotheses/questions those MOEs will be used to test or answer. The environmental analysis will utilize several data elements that will be provided by other national evaluation test plans, such as vehicle miles traveled data from the Traffic System Data Test Plan; Table 1-3 shows only those data elements that will be collected through this Environmental Test Plan. Chapter 3 (Data Analysis) describes how all of data elements—those collected through this and other test plans—will be utilized to test environmental hypotheses.

This test plan reflects two changes in methodology that have been made since completion of the Los Angeles County Congestion Reduction Demonstration National Evaluation Plan in January 2010. First, the emissions impact of changes in parking search times associated with the parking management system will no longer be considered because the local partners were unable to support the necessary data collection. By eliminating a potentially significant source of emissions and fuel reductions—perhaps greater than those associated with the HOT lanes—this analysis cannot provide a complete picture of CRD emissions and fuel impacts. Results from the San Francisco UPA evaluation of parking search time impacts will be noted in the LA results report but given the great differences between the two deployments and their contexts extrapolation of San Francisco results is not expected. Second, noise impacts will be not be considered. It was decided by the national evaluation team and U.S. DOT that noise would not be analyzed at any of the Urban Partnership Agreement (UPA)/CRD sites because significant impacts are unlikely and it would be very difficult to attribute any change to the UPA/CRD projects.

Table 1-2. Relationships Among Test Plans and Evaluation Analyses

LA CRD (Metro ExpressLanes) Program Test Plans	Evaluation Analyses										
	Tolling	Technology	Transit	Travel Demand Management (TDM)*	Congestion	Safety	Environmental	Equity	Business Impact	Non-Technical Factors	Cost-Benefit
Traffic System Data Test Plan	●		○	○	●	●	●	○			●
Tolling Test Plan	●	●			○		○	○	○		●
Transit System Data Test Plan	○		●	○	○		○	○			●
Ridesharing Test Plan				●				○			○
Safety Test Plan					○	●		○			●
Environmental Data Test Plan							●	○			○
Surveys, Interviews, Workshops Test Plan	●	●	●	●	○	○	○	●	●	●	
Content Test Plan										●	
Cost Benefit Test Plan											●
Exogenous Factors Test Plan	○	○	○	○	○	○	○	○	○	○	

● — Test Plan Data Constitutes a Major Input to the Evaluation Analysis

○ — Test Plan Data Constitutes a Supporting Input to the Evaluation Analysis

* The only Travel Demand Management (TDM) element included in the LA CRD are those related to ridesharing and therefore what is called the TDM Analysis in the evaluation plan documents for some of the other UPA and CRD sites is referred to as the Ridesharing Analysis in the LA CRD evaluation documents.

Table 1-3. Environmental Test Plan Data Elements Used in Testing Evaluation

LA CRD Environmental Data Element	LA CRD Measures of Effectiveness	LA CRD Hypotheses/Questions*
1. Emission factors for criteria and greenhouse gases from EMFAC 2011 model	• Reductions in emissions due to VMT reductions • Reductions in emissions due to increases in speed due to decreased congestion • Reductions in ozone precursors, PM, and greenhouse gases	• LAEnvironmental-1: Vehicle-related air emissions will decrease in the treatment corridors.
2. Fuel consumption factors from EMFAC 2011 model	• Reduction in energy use due to reduction in auto fuel consumption from decreased travel and congestion • Reduction in energy use due to reduced auto fuel consumption related to incidents as measured through changes in hourly average speeds	• LA-Environmental2: Vehicle-related fuel consumption will decrease in the treatment corridors.

*The full set of Los Angeles County CRD evaluation hypotheses/questions, including those related to environmental data which are identified in this table, are listed in Appendix A.

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2.0 DATA SOURCES, AVAILABILITY, AND RISKS

This chapter discusses the sources, availability and risks associated with the emission and fuel consumption factors data collected through this Environmental Data Test Plan. The role of other data that will be used in the environmental analysis and which will be collected or generated through other evaluation test plans is discussed in Chapter 3. Those other data consist of traffic volumes/vehicle miles traveled and average speeds from the Traffic System Data Test Plan.

Table 2-1 summarizes the source, data collection frequency and other key characteristics of the data elements to be collected through this Environmental Data Test Plan. These issues are discussed in the sections that follow Table 2-1.

Table 2-1. Summary of Data Needs for LA/CRD Environmental Test Plan

Data Element	Location	Data Granularity	Data Reporting Frequency	Responsible Agency (Data Source)	Data Access/ Transmittal to Evaluation Team
1. Emission factors for criteria and greenhouse gases from EMFAC 2011 model	LA County	Grams per mile by vehicle type, speed	On request in 2012 for years 2012 and 2013	SCAG	SCAG emails to Metro; Metro passes to Evaluation Team
2. Fuel consumption factors from EMFAC 2011 model	LA County	Fuel consumption per mile by speed and vehicle type*	On request in 2012 for years 2012 and 2013	SCAG	SCAG emails to Metro; Metro passes to Evaluation Team

* Vehicle type includes fuel type, vehicle technology (e.g., standard, hybrid, alternative fuel), and vehicle size (e.g., bus, motorcycle, passenger car, delivery vehicle).

2.1 Data Sources

This section describes the data to be collected through this test plan—emission and fuel consumption factors—that will be used in the environmental analysis.

The environmental analysis will employ the new EMFAC 2011 model to estimate emission rates and fuel consumption for motor vehicles. Over time, EMFAC 2011 is being phased in to replace the EMFAC 2007 model in all California regions required by the Clean Air Act to perform motor vehicle emissions inventories.

In the case of the LA CRD evaluation, emission factors and fuel consumption rates will be developed for years 2011 and 2012, to correspond to the pre- and post-deployment periods. To the extent possible the emission modeling will be conducted on a subarea basis to include the key traffic analysis facilities covering the affected portions of I-10 and I-110 as well as the areas directly surrounding and servicing those facilities.

2.2 Data Availability

Data availability is not expected to be a concern as SCAG has agreed to provide EMFAC 2011emission and fuel consumption factors for both the pre-deployment (2012) and post-deployment (2013) time periods, on request to the national evaluation team.

The emission factors will be transmitted to Metro by the SCAG regional transportation planning and data request staff in the form of EMFAC output tables and will include emissions (g/mi) by speed category and fuel consumption by vehicle class and speed. The output tables will be provided to Metro in electronic form and hard copy. Metro will relay these data to the national evaluation team.

2.3 Potential Risks

The relatively new nature of the EMFAC 2011 model (initial draft release in early August, 2011) may present some potential risk to the schedule if the modeling required for this analysis represents new procedures for SCAG. This risk is significantly lessened by the fact that the EMFAC generated data will not be required for quite some time: several months from the publication of this test plan. In addition, SCAG needs to incorporate procedures involving the use of EMFAC 2011 prior to our request for several ongoing planning purposes. The national evaluation team will continue to coordinate with SCAG prior to the deadline for the EMFAC generated data to help ensure that the data will be ready when needed.

Two other considerations—not technically "risks" since they are known and certain—pertain to: 1) The unavailability of any data to support calculation of the potential environmental impacts associated with any changes in parking search times (noted earlier) and 2) The inability to fully quantify any environmental impacts associated with the Phase 1 bus service improvements in the I-110 corridor. The later issue stems from the fact that the Congestion Analysis upon which the Environmental Analysis depends on traffic activity data contains a single "before" (or "baseline") condition defined as the 12 months prior to the first HOT lane implementation. However, this baseline condition begins after the Phase 1 bus service improvements. As explained in Section 3, a qualitative assessment of the possible environmental impacts of the Phase 1 bus service enhancements (which impact only the I-110 corridor) will be made based on consideration of Transit and Congestion Analysis results. Those results should provide an indication of whether a sufficient shift from driving to use of transit has occurred to generate any change in emissions.

3.0 DATA ANALYSIS

The before and after analysis of emissions and fuel consumption will be performed using the emission and fuel consumption factors for the pre- and post-CRD project implementation time periods, in combination with data from the test plans for traffic and surveys. The environmental analysis will calculate emissions and fuel impacts for all roadway links studied in the congestion analysis and for which the required VMT and average speed data are available. That is expected to include I-10, I-110 and major parallel arterials. As noted in Section 2.3, the environmental analysis will quantitatively examine the two scenarios being evaluated in the Congestion Analysis: a baseline condition consisting of the 12 months leading up to the first HOT lane implementation (a period that falls after the Phase 1 bus service enhancements on the I-110 corridor) and a post-deployment period consisting of the 12 months after the final HOT lane implementation. Evaluation resources are insufficient to support a full, quantitative analysis of possible environmental impacts associated with the Phase 1 bus service improvements. However, the evaluation team will attempt to qualitatively assess possible impacts based on a consideration of Transit and Congestion Analysis findings related to the Phase 1 bus service enhancements.

The primary data required for the environmental and energy analysis are changes in speed, VMT, mode, and modeled emission and fuel consumption per mile of travel. Exogenous factors will be addressed in so much as the travel inputs which drive the environmental analysis (hourly vehicle miles traveled and average speeds) output from the national evaluation's Traffic System Data Test Plan will have been adjusted if necessary and to the extent feasible to eliminate all but CRD-related change.

This section discusses the processes and procedures that will be used to analyze the data utilized in the environmental analysis, including travel inputs collected through other test plans and the emission and fuel consumption factors collected through this test plan. Two types of processes and procedures are discussed:

1. Preparation of the traffic system data and congestion analysis outputs for environmental analysis (for example preparing subarea-specific changes in VMT and speed by hour and day of week);
2. Use of the EMFAC 2011 model to estimate changes in pollution and energy use resulting from the CRD projects.

In summary, the environmental analysis will consist of multiplying changes in VMT and speed by regional emission rates and fuel consumption factors generated by the EMFAC 2011 model to calculate emission reductions resulting from the CRD projects. Changes will be estimated for weekdays and weekends and by hour, as well as totaled and summarized as daily, seasonal, and annual average reductions. This is a traditional approach that has been widely applied in congestion pricing air quality analyses.

The likely net emissions and fuel impacts of the LA CRD are challenging to predict and are of course greatly compromised by the inability to consider parking search time impacts. On one hand, the expected smoother traffic flow on I-10 and I-110 could increase average speeds and thereby reduce emissions. Further, some current single occupant vehicle drivers could shift to

the enhanced transit services, which would reduce VMT and also reduce emissions and fuel consumption. However , some current carpoolers may start driving alone now that they have the option of paying their way into the HOT lane as an SOV, thereby increasing VMT and associated emissions and fuel consumption. In addition, latent demand for use of the affected portions of I-10 and I-110 by people currently limiting their use, using alternate routes, or who have shifted the times of their travel may result in an overall increase in travel. Net mode shift changes should be reflected in this analysis through the VMT, but to provide further understanding of why VMT changed, the environmental analysis will examine mode shift results from the Los Angeles transit data and on-board surveys.

3.1 Preparation of the Traffic Data for Environmental Analysis

Traffic volume data provided by the national evaluation Traffic Test Plan will be aggregated both spatially and temporally. For most roadway analysis segments, the data is collected lane by lane by loop detectors and will be aggregated up to a link and, finally, corridor values. Data is continuous, collected at five minute intervals. Data will be evaluated primarily at a segment level to differentiate between emission changes occurring in different parts of the study area. The traffic data will be processed by TTI to provide hourly before and after traffic volumes and speeds along the affected portions of I-10 and I-110 and their parallel arterials.

Although the absence of data on parking search time changes eliminates the ability to assess emissions and fuel impacts of the LA CRD parking management project, results of the analysis of SF*park* system at the San Francisco UPA site will be referenced in the LA environmental analysis results report.

3.2 Contextual Data for Environmental Analysis

In addition to calculating the emission impacts associated with project-related changes in VMT and average speeds (from the Traffic System Data Test Plan), the overall environmental analysis will also include consideration of the results of the vanpooling and transit ridership surveys as well as other mode shift results from throughout the national evaluation. This information may help explain how much of any observed changes in VMT are related to CRD-precipitated mode shift. A significant portion of the CRD project involves increasing transit services through the addition of new buses, enhanced services such as improvements to the silver line, addition of 100 vanpools, changes to transit centers, and transit signal priority. The net effect should be an increase in shared modes such as transit or carpooling, though it is also expected that some existing carpools will break up and some existing transit riders will switch back to driving once the option to use the HOV lanes in exchange for a toll becomes available. In addition, other latent demand may exist for use of these facilities which may offset some of the VMT and speed changes.

3.3 Estimating Emissions and Fuel Consumption Using EMFAC 2011

SCAG will provide emission factors for each pollutant of interest for 2012 and 2013, by speeds, generated using the EMFAC 2011 model. The pollutants of interest are ozone precursors volatile organic compound [VOC] and nitrogen oxide [NOx]), greenhouse gases (e.g., CO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$). These county level factors (for LA County), expressed in grams per mile, by speed, will be applied to changes in VMT and speed by roadway to estimate hourly emissions for weekdays and weekends in the baseline and the post-deployment periods. Emissions will be summed across all roadway segments and compared to evaluate changes occurring after deployment. This will form the basis of addressing the assessment of the first environmental hypothesis on air quality improvement. Summaries by roadway segment, time of day, season, and by weekdays and weekends will be evaluated.

Fuel consumption rates will be applied to VMT changes in a similar manner as for the air quality analysis to analyze energy impacts. This will address the second environmental hypothesis on energy consumption.

Finally, the environmental data analysis must support both the equity and cost-benefit analysis to address the hypotheses related to these evaluation issues. The primary means of assessing the equity implications of air quality and energy impacts is to determine whether these impacts are disproportionally distributed by socioeconomic strata (e.g., income, ethnicity, age, etc.) or geography. The environmental analysis will supply emission and fuel consumption findings for different portions of the analysis area to the equity analysis in order to apply socioeconomic characteristics from each portion of the study area to derive any differential impacts on key groups. In terms of the cost-benefit analysis, changes in emissions and fuel consumption will be monetized in order to assess their contribution to the benefits of the project and its attendant elements. The estimated air quality and energy impacts will serve as input to the cost benefit analysis.

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4.0 SCHEDULE AND RESPONSIBILITIES

SCAG will be responsible for providing to the national evaluation team the EMFAC 2011-generated emission factors and fuel consumptions for calendar years 2012 and 2013, relayed to the national evaluation team via Metro. The factors will be provided on request to the national evaluation team sometime during calendar year 2012, with a more specific timetable to be communicated to SCAG in early 2012. The national evaluation team will perform the emissions and fuel consumption analysis in spring of 2013, after all post-deployment data is available. The national evaluation team will also be responsible for reporting on the findings in the LA CRD evaluation report.

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APPENDIX A – HYPOTHESES/QUESTIONS FROM THE L.A. COUNTY CRD NATIONAL EVALUATION PLAN

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
Congestion	LACong-1	Deployment of the CRD improvements will reduce the travel time of users in the I-10 and I-110 corridors.
	LACong-2	Deployment of the CRD improvements will improve the reliability of user trips in the I-10 and I-110 corridors.
	LACong-3	Deployment of the Downtown LA Intelligent Parking Management Project will reduce congestion in the downtown.
	LACong-4	Deploying the CRD improvements will result in more vehicles and persons served in the I-10 and I-110 corridors during peak periods.
	LACong-5	Will surveyed travelers perceive a noticeable reduction in travel times in the treatment corridors?
	LACong-6	Will surveyed travelers perceive a noticeable improvement in trip-time reliability in the treatment corridors?
	LACong-7	Will surveyed travelers perceive a noticeable reduction in the duration of congested periods in the treatment corridors?
	LACong-8	Will surveyed travelers perceive a noticeable reduction in the length of peak congestion periods in the treatment corridors?
	LACong-9	Relative travel times for HOV/HOT lanes vs. general purpose lanes will either remain the same or (more likely) improve for HOV/HOT travelers as a result of the CRD deployments.
	LACong-10	The introduction of tolled SOV traffic into the HOT lanes in the deployment corridors will not negatively impact HOV or transit traffic in terms of average travel times or travel reliability.
	LACong-11	The CRD deployment will not cause traffic congestion to increase in the HOV/HOT lanes.
	LACong-12	Because of latent demand in the deployment corridors, the CRD deployments are not likely to impact in traffic congestion on the general purpose lanes.
	LACong-13	Because of the CRD deployments, congestion on the arterials streets paralleling the corridors will be reduced.

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
Tolling	LATolling-1	The HOT lanes will regulate vehicular access to the I-10 and I-110 and improve their operation.
	LATolling-2	Some general-purpose lane travelers will shift to the HOT lanes, while HOV lane travelers will continue to use them after they are converted to HOT.
	LATolling-3	After ramp-up, the HOT lanes on I-10 and I-110 pricing maintains operating improvements on I-10 and I-110 after the initial ramp-up period.
	LATolling-4	The downtown IPM project will result in 70-90% of the parking spaces on each block occupied throughout the day.
	LATolling-5	The downtown IPM project may increase parking revenues that can be used to fund system expansion in other high-demand areas.
	LA Tolling-6	Implementing the HOT lanes will reduce the HOV violation rate.
Transit	LATransit-1	CRD projects will enhance transit performance within CRD corridors through reduced travel times, increased service reliability, and increased service capacity.
	LATransit-2	User perceptions of security at transit stations/park-and-ride lots will be improved by CRD projects.
	LATransit-3	CRD projects will increase ridership and facilitate a mode shift to transit within CRD corridors.
	LATransit-4	Increased ridership and mode shift to transit will contribute to increased person throughput, congestion mitigation, and transit cost-effectiveness within CRD corridors.
	LATransit-5	What was the relative contribution of each CRD project element to increased ridership/ transit mode share/person throughput?
Ridesharing	LARideshare-1	CRD vanpool promotion will result in at least 100 new Metro-registered vanpools.
	LARideshare-2	Which factors were most effective in promoting ridesharing?
	LARideshare-3	Will CRD HOT and transit improvements lead to unintended breakups of current carpools/vanpools?
Technology	LATech-1	Travelers will access the IPM website and telephone information system.
	LATech-2	IPM will improve LADOT's ability to reconfigure parking restrictions and rates.
	LATech-3	IPM will improve LADOT's ability to enforce parking regulations.

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
Safety	LASafety-1	The collective impacts of CRD improvements[3] will be safety neutral or safety positive.
	LASafety-2	The addition of transition zones will not increase incidents.
	LASafety-3	Will boundary jumping cause incidents?
	LASafety-4	Will HOT infrastructure changes affect the time needed to respond to or clear accidents?
	LASafety-5	Will adjusted enforcement procedures affect the number of incidents?
Equity	LAEquity-1	What is the socio-economic and spatial distribution of the direct social effects of the CRD projects?
	LAEquity-2	Are there any differential environmental impacts on certain socio-economic groups?
	LAEquity-3	Will the potential HOT lane net revenues be reinvested in an equitable manner?
Environmental	LAEnvironmental-1	Vehicle-related air emissions will decrease in the treatment corridors.
	LAEnvironmental-2	Users of the two corridors will perceive improvements in air quality as a result of the CRD projects.
	LAEnvironmental-3	Vehicle-related fuel consumption will decrease in the treatment corridors.
Business Impacts	LABus-Imp-1	How will the downtown IPM project affect retailers and similar businesses that rely on customers' ability to access their stores?

[3] Relevant UPA changes include narrower lanes on portions of the I-10 freeway, new signage, new HOT procedures, new enforcement procedures, and reduced congestion (i.e., faster flowing traffic).

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
Non-Technical Success	LANon-Tech-1	What role did factors related to these five areas play in the success of the deployment? 1. People: Sponsors, champions, policy entrepreneurs, neutral conveners, legislators 2. Process: Forums (including stakeholder outreach), meetings, alignment of policy ideas with favorable politics and agreement on nature of the problem), legislative and Congressional engagements 3. Structures: Networks, connections and partnerships, concentration of power & decision making authority, conflict mgt. mechanisms, communications strategies, supportive rules and procedures 4. Media: Media coverage, public education 5. Competencies: Cutting across the preceding areas: persuasion, getting grants, doing research, technical/technological competencies; ability to be policy entrepreneurs; knowing how to use markets
	LANon-Tech-2	Does the public support the CRD strategies as effective and appropriate ways to reduce congestion?
Cost Benefit	LACostBenefit-1	Will the LA CRD (Metro ExpressLanes) Program projects have a net societal benefit?

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