ICM Deployment Planning – The I-210 Connected Corridors Pilot

(San Gabriel Valley/Los Angeles County)

Prepared for: The Federal Highway Administration (FHWA)

Prepared by: The California Department of Transportation (Caltrans)

Introduction

The California Department of Transportation (Caltrans) is pleased to submit this application for the "ICM Deployment Planning Grant." The project is "The I-210 Connected Corridors Pilot (San Gabriel Valley/Los Angeles County)." The funds will be used for the ICM Analysis, Modeling, and Simulation Plan. Hereinafter, the project will be referred to as the "CC Pilot."

Caltrans, whose mission is to improve mobility across California, is responsible for planning, design, construction, maintenance, and operation of the state highway system and is divided into twelve districts throughout the state. Caltrans District 7, which includes Los Angeles and Ventura counties, is responsible for 42 freeways and highways, including Interstate 210 (I-210) where the CC Pilot is located.

Connected Corridors is an Integrated Corridor Management (ICM) program aimed at reducing congestion and improving mobility by incorporating ICM "best practices" and new/upgraded technologies. It will first be implemented as a pilot on the I-210, and then expanded to fifty congested corridor segments over the next ten years to become a broader Caltrans program called "ICM California." The Connected Corridors team (including the Los Angeles County Metropolitan Transportation Authority – Metro, the Los Angeles County Department of Public Works - LACDPW, and Partners for Advanced Transportation Technology – PATH, at the University of California, Berkeley), in collaboration with numerous additional stakeholders, will investigate tools and technologies to coordinate the components of the corridor and operate them as a cohesive and integrated system. Building on other successful ICM projects in the U.S. and abroad, and networking with the San Diego Association of Governments (the lead agency for the I-15 ICM project), the project is one element of Caltrans' strategic response to the state's objectives of enhancing the livability, sustainability, and economic performance of California. By empowering both motorists and corridor managers to make better decisions, a wholly new set of performance management strategies is possible and new paradigms for cooperative traffic management will result.

Section 1: Description of the Corridor

The I-210 corridor includes many attributes that are ideal for an ICM pilot demonstration, including:

- A well-instrumented roadway (in-pavement sensors on the freeway mainline and ramps, with collected data automatically processed through the Performance Measurement System)
- Directional traffic flow corresponding to morning and evening commute hours
- A good network of parallel arterials linked to the congested freeway
- Existing infrastructure investments that can be leveraged
- Extensive transit service, a network of bicycle lanes, and parking/park-and-ride facilities

The CC Pilot is located on a 22-mile section of the I-210 freeway (the Foothill Freeway) in the San Gabriel Valley in Los Angeles County. It extends from the SR-134/I-210 interchange near downtown Pasadena to the Foothill Boulevard interchange in La Verne. This section of the I-210 runs through an urban environment and includes the most heavily congested sections of the freeway (see Figure 1 below). Due to the magnitude of the project, it will be divided into two phases: The first phase will be between SR-134 and I-605 in the cities of Pasadena, Arcadia, Monrovia, and Duarte ("Segment 1"). The second phase will extend the project from I-605 to Foothill Boulevard in the cities of Irwindale, Azusa, Glendora, and San Dimas ("Segment 2").

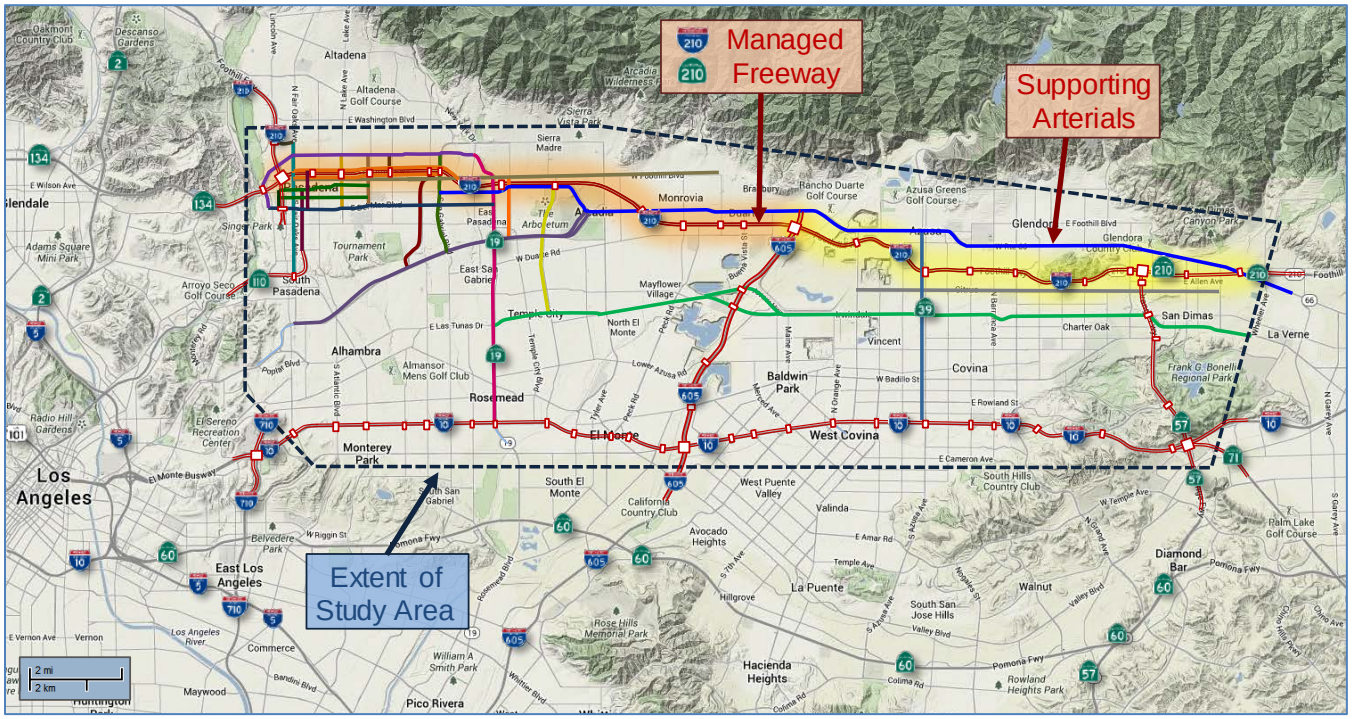

Figure 1: I-210 Corridor Study Area

The I-210 is a vital link for the San Gabriel Valley region of the Los Angeles metropolitan area with four general-purpose lanes in each direction and additional auxiliary lanes between some interchanges. A single buffer-separated High Occupancy Vehicle (HOV) lane operates at all times in each direction of travel from the SR-134 in Pasadena to the I-215 in San Bernardino. Trucks currently comprise between four and five percent of total daily traffic in the corridor, and this proportion is expected to increase over time.

Caltrans District 7 operates the Los Angeles Regional Transportation Management Center (TMC) in partnership with the California Highway Patrol (CHP) to rapidly detect and respond to incidents while managing the resulting congestion. Additionally, Los Angeles County has a regional Traffic Management Center in Alhambra, and both the cities of Pasadena and Arcadia have local Traffic Management Centers.

In addition to being an important commute corridor within the metropolitan Los Angeles area, the I-210 freeway also provides access to several large trip generators. There are five major regional shopping malls in the vicinity of the freeway, five warehouse and distribution “clusters,” approximately ten university and college campuses, eight major medical centers, and several event venues. Among the notable event venues are the Rose Bowl with 90,000 seats; the Rose Bowl Aquatic Center; Santa Anita Park for thoroughbred horse racing and other events; the Pasadena Convention Center; the Irwindale Event Center; the Huntington library, art gallery, and botanical garden; and the Los Angeles County Arboretum and Botanical Garden.

Section 2: Corridor Transportation Assets

Freeways

As noted on Figure 1, several other freeways near the I-210 provide alternate travel routes within the corridor study area. They include:

1. **I-10 (San Bernardino Freeway)** – Freeway parallel to I-210 providing an east-west alternate route to downtown Los Angeles from communities in the San Gabriel Valley and San Bernardino areas.
2. **I-605 (San Gabriel River Freeway)** – North-south freeway connecting the I-210 near Irwindale with the I-10, SR-60, I-5, I-105, SR-91, and I-405 freeways to the south. It terminates near Seal Beach.
3. **SR-57 (Orange Freeway)** – North-south freeway connecting the I-210 near San Dimas with the I-10, SR-60, I-5 and SR-22 freeways near Orange to the south.

The following freeways provide additional connections to other areas of the Los Angeles region:

1. **SR-134 (Ventura Freeway)** – East-west freeway linking Pasadena to the San Fernando Valley and Ventura.
2. **SR-110 (Arroyo Seco Parkway)/I-110 (Harbor Freeway)** – North-south freeway linking Pasadena to downtown Los Angeles, South Los Angeles, Carson, and the Port of Los Angeles near San Pedro.
3. **I-710 (Long Beach Freeway)** – North-south freeway linking Alhambra to East Los Angeles and Long Beach. While this freeway currently ends just north of the I-10 freeway, studies are currently exploring the possibility of extending it through South Pasadena to the I-210/SR-134 interchange.

Arterials

The key arterials in the I-210 corridor include:

1. **East Orange Grove Boulevard** – Four-lane roadway running through the northern part of Pasadena.
2. **Maple Street and Carson Street** – Pair of two-lane unidirectional frontage roads running on each side of I-210 through Pasadena.
3. **Walnut Street/Foothill Boulevard** – Four-lane roadway through Pasadena, Arcadia, and Monrovia; generally less than ¼ mile from the freeway.
4. **Colorado Boulevard** – Four-lane roadway through downtown Pasadena, ½ mile south of the I-210.
5. **Huntington Drive –** Six-to-eight lane arterial running from the Santa Anita Park area through Arcadia, the East Pasadena unincorporated area of Los Angeles County, San Marino, and South Pasadena.
6. **Huntington Drive/Foothill Boulevard/Route 66/Acosta Avenue** – Four-lane roadway running north of the freeway through Arcadia, Monrovia, and cities to the east.
7. **Las Tunas Drive/Live Oaks Avenue/Arrow Highway** – Succession of four-lane roadways 1-¼ miles south of the I-210.
8. **Gladstone Street** – Four lane roadway running less than ½ mile south of the I-210.

Public Transit Service

There is excellent public transit service in the corridor:

- **Metro Gold Line** – Light-rail line connecting Pasadena to downtown Los Angeles. While it currently ends in Pasadena, this line is being extended by 11.5 miles to a new terminal in Azusa. A second expansion phase further proposes to extend the line by an additional 12.3 miles east to Montclair.
- **Metrolink's San Bernardino Line** – Commuter rail line running between the I-210 and I-10 freeways and providing an alternate transportation mode to downtown Los Angeles.
- **Metro's Silver Line** – Rapid bus service along the I-10.
- **Commuter Express Bus Lines** – Several Foothill Transit and Los Angeles Department of Transportation (LADOT) lines operate in the corridor.
- **Local Bus Service** – Local bus lines in the corridor are operated by Foothill Transit, the cities, and Metro.

- **Park-and-Ride Lots** – There are currently 33 park-and-ride lots in the corridor including facilities operated by Metro along the existing Gold Line (and planned/under construction for the Gold Line extension); facilities near the Metrolink commuter rail stations; facilities operated by Caltrans along the I-210 and SR-57; one facility operated by LA County along the I-10 near the SR-57 interchange; and various facilities operated by cities or private entities (such as colleges, malls, and churches) through cooperative agreements with public transportation agencies.

Field Elements

The deployed traffic management field elements within the I-210 corridor include:

- **Freeway Mainline Traffic Sensors** – Along the I-210, Caltrans maintains 42 mainline traffic detection stations in the eastbound direction and 46 stations in the westbound direction between the SR-134 and Foothill Boulevard interchanges. These stations are mapped in Figure 2. Detection stations typically consist of single-loop, in-pavement sensors measuring vehicle counts and loop occupancy. Detection stations are typically installed just upstream of an on-ramp and extend into the HOV lane.

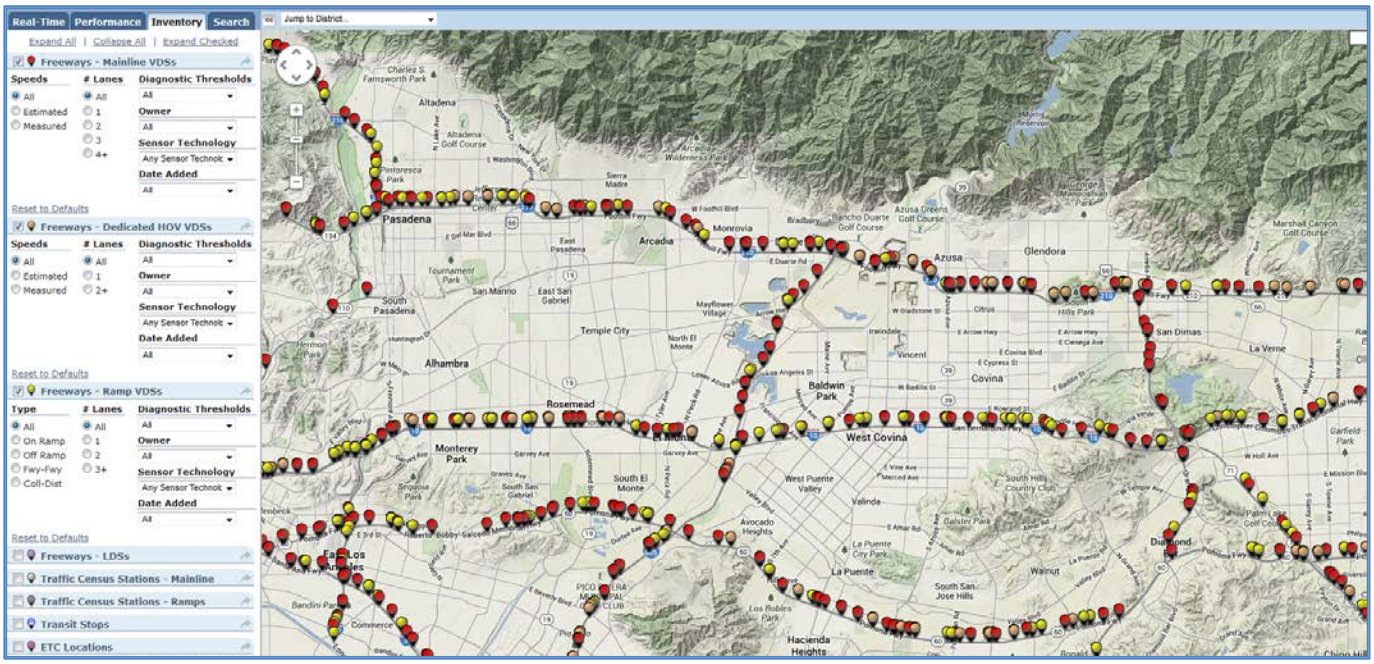

Figure 2: Freeway Sensor Locations

- **Freeway Ramps Traffic Sensors** – All on-ramps along the I-210 are equipped with traffic sensors. This includes meter stop line sensors, traffic count sensors near the merge point with the mainline freeway lanes, and queue detection sensors at the entrance of the ramp. Most of the off-ramps are further equipped with single loop sensors providing vehicle flow and loop occupancy data.
- **Performance Measurement System (PeMS)** – PeMS is a web-based tool that was developed by Caltrans and the University of California, Berkeley to retrieve, process, analyze, and store data collected by the traffic sensors noted above. In operation since 1999, the system allows users to retrieve and analyze data

from Caltrans sensors on the freeway and ramps, Caltrans' Lane Closure System, CHP incident reports, and accident records from the Traffic Accident Surveillance and Analysis System (TASAS).

- **Arterial Traffic Sensors** – Arterial traffic sensors are typically used to support signal operations, such as detecting the presence of vehicles waiting for a green signal or monitoring the interval between successive vehicles. Some detection stations are also used to measure traffic volumes on intersection approaches. Detection is primarily achieved using in-pavement loops. Video detection systems are also being used at 58 intersections in Pasadena. While significant traffic detection capability exists, the collected information is not always forwarded to a traffic management center. Pasadena collects data once a day and Arcadia every few minutes.
- **Travel Time Sensors** – The City of Arcadia currently maintains a network of 13 Bluetooth stations that are used to monitor travel times between key intersections within the city's road network. Pasadena is also testing a system along Orange Grove Boulevard estimating arterial travel times based on traffic flow and queue measurements.
- **Closed-Circuit Television (CCTV) Cameras** – Caltrans currently operates more than 25 CCTV cameras connected to the regional TMC within the I-210 corridor – some for exclusive use by Caltrans staff, and some accessible to the information service providers via a public website. Both the cities of Pasadena and Arcadia also operate networks of CCTV cameras connected to their respective TMC. This includes 31 cameras within Pasadena and 10 cameras within Arcadia.

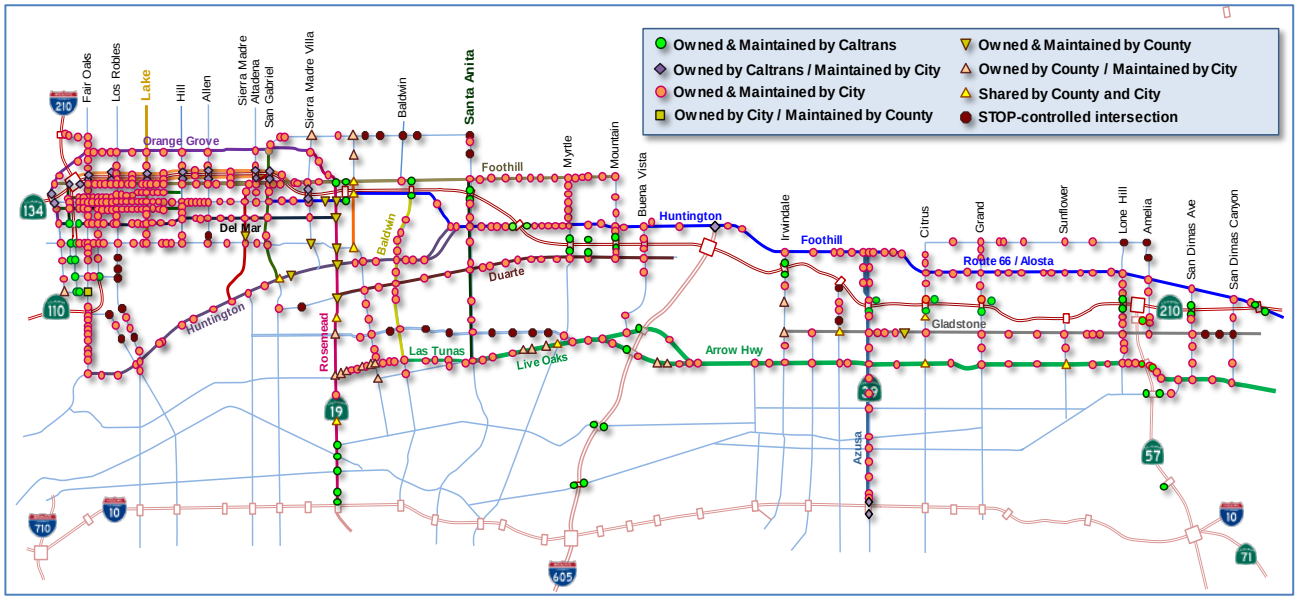

Figure 3: Location and Ownership of Signalized Intersections

- **Traffic Signal Control Systems** – Figure 3 above maps the location and operational ownership of signalized intersections along key arterials within the I-210 corridor. As can be observed, the density of signalized intersections is significantly greater in the western end of the corridor. Figure 3 further provides an inventory of the traffic management systems used by individual jurisdictions. The most commonly used system within the corridor is Kimley-Horn's Integrated Transportation System (KITS). This system, which was developed for LA County, is used in the unincorporated areas of the county and in several jurisdictions that have elected to have the County operate their signals. The use of four different systems

by the City of Pasadena, including a real-time Sydney Coordinated Adaptive Traffic System (SCATS), is also worth noting.

- **Transit Signal Priority (TSP)** – Transit signal priority currently exists along a section of Fair Oaks Boulevard on Metro's Rapid Route 762 and Colorado Boulevard on Metro's Rapid Route 780 in Pasadena. This system can provide a green extension or early green return of up to 10% of the signalized cycle. While not currently operational, another TSP corridor is in construction along a route parallel to I-210 that would include Colorado Boulevard in Pasadena, Huntington Drive in Arcadia, and Foothill Boulevard east of Arcadia operating on Foothill Transit's Route 187. The city of Pasadena is developing a corridor TSP plan.
- **Incident/Event Management Systems** – There are several assets used to manage incidents and events in the I-210 corridor. They include: Caltrans' Lane Closure System (LCS); the CHP's Computer-Aided Dispatch (CAD) system; Caltrans District 7 All-Purpose Incident Detection (APID) algorithm; the Los Angeles Regional TMC (LARTMC); the Freeway Service Patrol (FSP); and Transportation Management Teams dispatched from the LARTMC.
- **Transit Management Systems** – LA Metro's vehicles are equipped with an Automatic Vehicle Location (AVL) system to track the position of each vehicle. All buses operated by Metro and Foothill Transit are further equipped with Automated Passenger Counting (APC) devices to track ridership.
- **Traveler Information Systems** – The traveler information systems currently in operation along the corridor include changeable message signs (six are located on the freeway in the pilot corridor and five are located in Pasadena), highway advisory radios (HARs), the NextTrip transit vehicle arrival/departure information system utilized by Metro and Pasadena ARTS, and the Go511 traveler information service.
- **Information Exchange Capabilities** – Two systems currently enable corridor stakeholders to obtain and/or exchange information regarding the operations within the I-210 corridor: the Regional Integration of Intelligent Transportation Systems (RIITS) and the Information Exchange Network (IEN)**.** See Section 5 for more details on these systems.

Section 3: Key Performance Issues in the I-210 Corridor

The key performance issues in the I-210 corridor include recurrent bottlenecks, vehicle delays, unreliable travel times, the number and duration of accidents, and lack of inter-jurisdictional and inter-agency coordination. Each of these is described briefly below:

Recurrent Bottlenecks: The I-210 Corridor System Management Plan (CSMP) identified the AM peak and PM peak recurring bottlenecks that existed along the freeway in late 2007 and early 2008. An analysis of recent traffic flow data compiled in PeMS indicates that the identified bottlenecks are still the primary causes of congestion along the I-210. Figures 4 and 5 below show the bottleneck locations and issues associated with the bottlenecks. As can be observed, most of the bottlenecks are associated with locations with significant weaving maneuvers due to traffic entering or exiting the freeway. In some cases, the weaving effects are further compounded by roadway geometry factors such as sharp curves or lane drops.

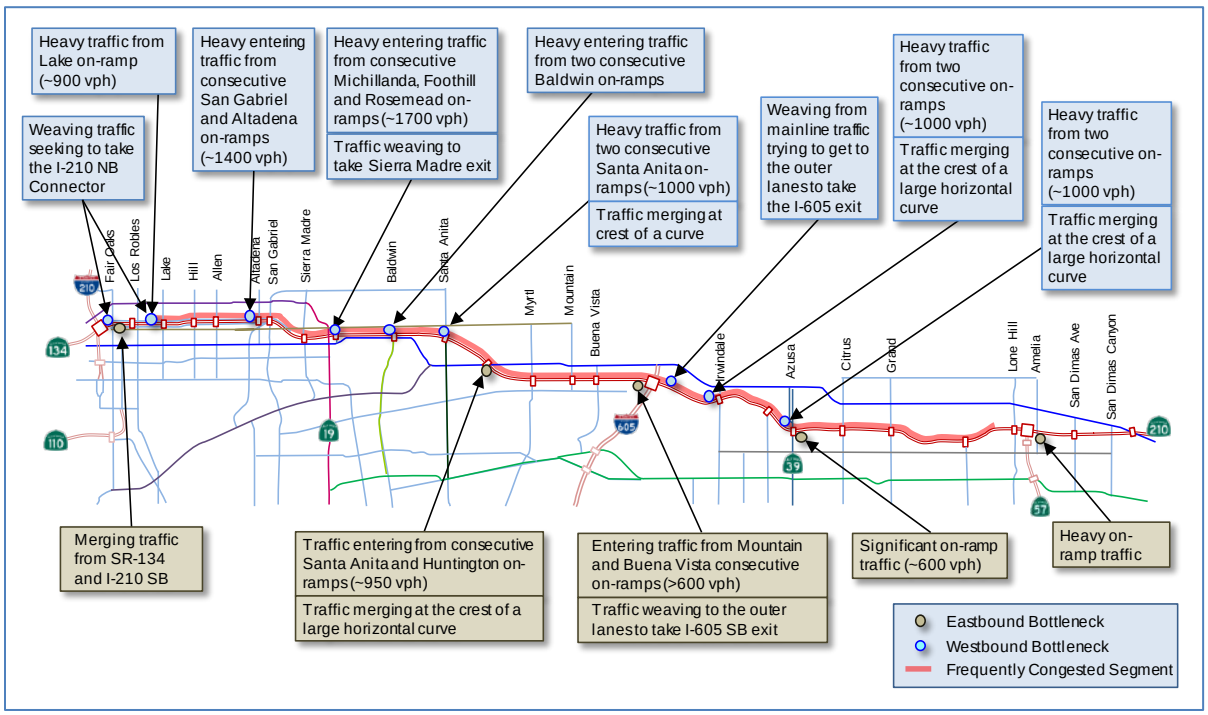

Figure 4: AM Peak Bottlenecks and Congestion Areas

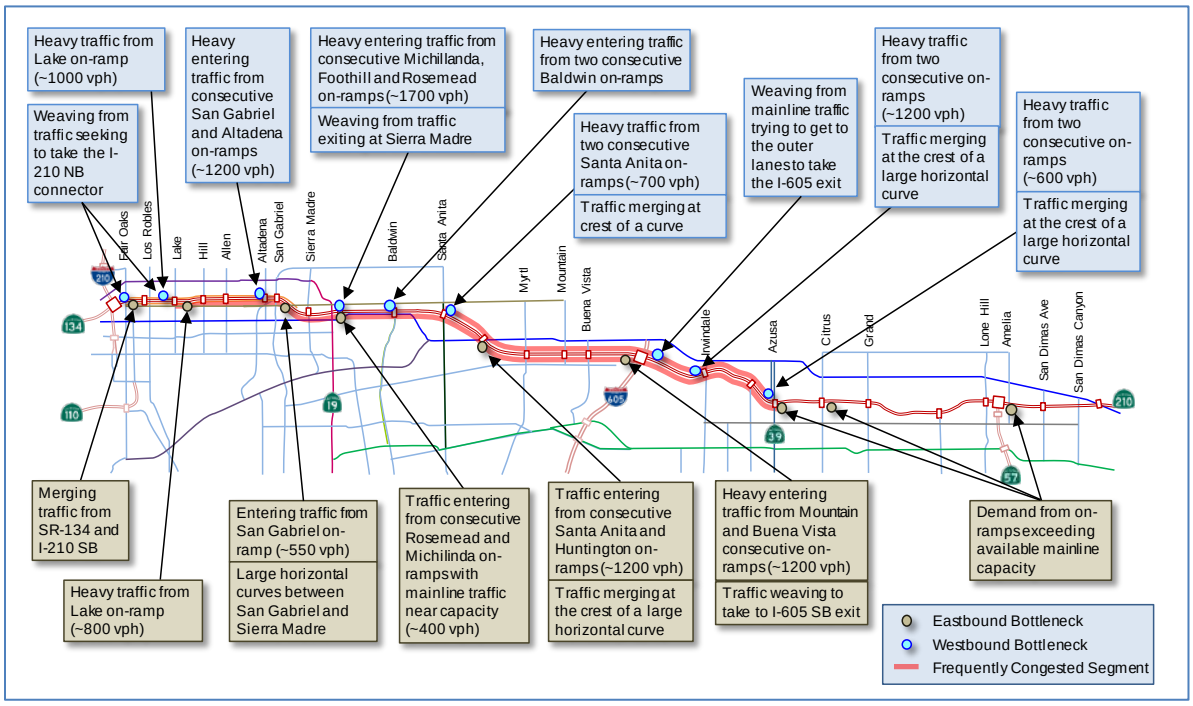

Figure 5: PM Peak Bottlenecks and Congestion Areas

Vehicle Delays: Caltrans PeMS data shows that between September 2012 and August 2013 most of the delays on the I-210 occurred between the SR-134 and SR-57 interchanges. For both directions, traffic demand is usually the lowest on Monday and gradually increases throughout the week, reaching a peak on Friday. This trend results in motorists experiencing significantly larger delays on Thursdays and Fridays than earlier weekdays. Between January 2008 and August 2013, the data further shows that delays have decreased 30% in the westbound direction and increased 12% in the eastbound direction. Several potential factors are invoked to explain these

trends: shifts in travel patterns due to the economic recession, the activation of freeway-to-freeway metering at the I-210/I-605 interchange, and construction projects along the I-210 and nearby freeways.

Unreliable Travel Times: The data shows that travel times in the I-210 corridor exhibit significant variability within each day, particularly during the PM peak periods, and largely due to the number and extent of incidents. Other key observations include significant differences in the duration of the congested period on a given day from one week to the next, large travel time fluctuations – up to 23 minutes – in the eastbound direction on Friday afternoons, and typically shorter travel times on days preceding or following a holiday weekend.

Accidents: Accident data for 2011 (the most recent year with a complete set of incident records from the CHP and PeMS) shows that on the I-210 from SR-134 to SR-57, an average of 24 incidents were logged daily during the week, and 12 daily incidents during weekends or holidays. These frequencies indicate that days without incidents are rare. The section of the I-210 between Rosemead Boulevard and the I-605 freeway has the highest incident rates per million miles traveled – not surprising since this section also has high traffic demand and numerous bottlenecks. The frequency with which the Caltrans Traffic Management Team (TMT) is dispatched to assist the CHP with emergency lane and freeway closures is another indicator of the impacts of incidents on traffic. The team is only dispatched for incidents expected to last two or more hours. Between 2009 and 2012, the TMT was deployed 48 times on the I-210 between SR-134 and Foothill Boulevard to help with events that ranged in duration from 0.8 hours to 13.5 hours, with an average of 5.4 hours. Data from the Caltrans Traffic Accident Surveillance and Analysis System (TASAS) from January 1, 2006 to December 31, 2011 further indicates that an average of 1,896 incidents was logged each year over the corridor. Rear-end collisions accounted for 53% of these incidents, which strongly suggests the presence of congestion. Sideswipes, broadside accidents, and rear-end collisions accounted for 80% of accidents. The data also shows the primary causes of the incidents were driver-related factors such as speeding (53%), various traffic violations (25%), and improper turning movements (11%). Changeable message signs, dynamic speed limits, dynamic ramp metering, arterial (and freeway) rerouting are all strategies the CC Pilot will consider to reduce collisions and/or their impact on the corridor. Additionally, faster incident response times, another strategy the CC Pilot will investigate, could further improve traffic flow.

Lack of Inter-Jurisdictional and Inter-Agency Coordination: While LACDPW, the cities, and transportation agencies in the I-210 corridor communicate on some issues and participate on some transportation committees together, a corridor-wide, inter-jurisdictional, and inter-agency project that brings together all of the stakeholders had been absent until the start of the CC Pilot. With improved coordination, and the willingness to operate the corridor as a system, improvements will happen. This is one of the goals of the CC Pilot.

Section 4: Stakeholders

Caltrans understands that the CC Pilot stakeholders are the key to the project's success. Early on, Caltrans began engaging stakeholders, and the effort has expanded substantially in the past year. In addition to involving the local Caltrans District (District 7), which provides leadership with its "I-210 Pilot Project Manager" (and the full support of the Deputy District Director of Operations and staff), the core stakeholders include Metro, LACDPW, and PATH. In June 2013, a project "Kick-Off Meeting" was held to provide project details, assign roles and responsibilities, and plan additional stakeholder meetings. The group meets regularly with weekly conference calls and monthly in-person meetings. The core stakeholders are responsible for freeway operations and maintenance, as well as designing the decision support system, managing the traffic management centers, bus and light rail

operations, transportation planning and funding in Los Angeles County, the 511 traveler information services, signalized intersection control in the unincorporated areas of the county and on behalf of some of the I-210 cities, and more.

Next, the city stakeholders were contacted and engaged. Thus far, in Segment 1 of the I-210 corridor, which includes Pasadena, Arcadia, Monrovia, and Duarte, initial and technical meetings have been held with all of the city staff. Each meeting included at least one representative from the city, Caltrans, Metro, LACDPW, PATH, and at least one city representative from an adjacent city.

Plans are underway to engage the next group of Segment 1 stakeholders. This includes Foothill Transit bus service to the San Gabriel and Pomona valleys; the San Gabriel Valley Council of Governments formed in 1994 to work on regional issues and help forge consensus in addressing issues that affect its 31 cities; the Southern California Association of Governments (the Metropolitan Planning Organization for Southern California, representing six counties, including Los Angeles County); and the City of Los Angeles. Federal partners at the FHWA and FTA will also be participants in the CC Pilot.

An initial "Letter Agreement" has been drafted and circulated to the core stakeholders and the cities as a first step towards a more formal "Memorandum of Understanding." It is anticipated that the Letter Agreement will be complete and signed by June 2014, and that the Memorandum of Understanding will be executed after the stakeholders have drafted, reviewed, and finalized the System Engineering Management Plan (SEMP) and the Concept of Operations (ConOps). Some of the I-210 Segment 1 cities have existing Cooperative Agreements and/or Agreements with the LACDPW for participation in the traffic signal synchronization program and the traffic signal control system and communication network.

Later in the project, additional stakeholders will be asked to engage in the process. These include the CHP and other first responders, fleet operators, Chambers of Commerce, and local business or non-profit organizations. The CC Pilot stakeholders will also develop and agree upon a governance structure which may include a Policy Oversight Committee, Technical Advisory Committee, Staff Working Group, Travel Demand Management Working Group, Performance Management Working Group, and others to be determined.

The CC Pilot stakeholders currently participate in various other efforts in the region and are working cooperatively on the following committees and projects:

- The Metro Gold Line Foothill Extension Construction Authority – the design, contracting, and construction agency for the extension of the light rail line east of Pasadena
- The San Gabriel Valley Council of Governments (SGVCOG) Transportation Policy Committee and the Public Works and Engineering Technical Advisory Committee
- Metro's Signal Synchronization & Bus Speed Improvements Program, Arterial ITS Configuration Management Subcommittee, and the Regional Integration of ITS (RIITS) Program.
- Caltrans District 7 and Metro coordinate on multiple projects and programs (both past and current) that demonstrate a high level of communication and cooperation, including the Express Lanes Demonstration Project, which won the 2013 Excellence in Transportation Award and the 2013 Partnered Project of the Year Award.

Section 5: Integrated Decision-Making, Operational, and Data Systems

Traffic Signal Synchronization: Arterial traffic signal synchronization along the I-210 corridor is currently fragmented. Traffic signals are operated by Caltrans, LACDPW, and individual cities:

- Caltrans: Controls the signals at the start or end of a freeway ramp, except where operation has been relinquished to a local jurisdiction.
- LACDPW: Operates signals in the unincorporated areas of the county, as well as signals where a local city has opted for county operations.
- Cities: Operate signals within the city boundaries.

The I-210 cities have made significant efforts to synchronize signals along major arterials. Primarily through the Los Angeles County Traffic Signal Synchronization Program (TSSP), signals have been coordinated across jurisdictional boundaries for a limited number of key arterials. While notable, these efforts still fall short of adequately covering all major arterials in the I-210 corridor.

A particularly significant issue within the corridor is the lack of coordination between the signals operated by Caltrans and those operated by local agencies. On arterials where Caltrans operates the signals, there is typically no direct synchronization with the neighboring signals, resulting in breaks in coordination along key arterials. Within the Caltrans system, there is also no link between the freeway ramp meters and the local signals, thus limiting the ability to fully control the traffic around freeway ramps.

Traffic Management Centers and Signal Control: Larger agencies in the corridor have traffic management centers (TMCs) that provide signal control from a central location, including LACDPW, and the cities of Pasadena and Arcadia. Caltrans operates its signals on a time-of-day basis without direct communication with a centralized system, although coordination between two adjacent Caltrans-operated signals often exists. Through the KITS system, LACDPW further has the ability to control the traffic signals of local jurisdictions that have opted to relinquish operations to the agency. KITS can also be a "host" for local agencies who desire to remain in control of their signal operations, but do not have their own traffic control system. In the I-210 corridor, the cities of Duarte and Monrovia currently utilize this option.

Los Angeles County's Information Exchange Network (IEN): To facilitate the exchange of information, as well as cross-jurisdictional signal operations, Los Angeles County has deployed the IEN. It supports XML data communications, and allows participating agencies to share traffic signal information and control signals in another agency when appropriate agreements are in place. In the I-210 corridor, LACDPW, Pasadena, and Arcadia participate, and there are continuing efforts to include additional jurisdictions.

Regional Integration of Intelligent Transportation Systems (RIITS): RIITS, which was developed by Metro, is a platform to support real-time information exchange among freeway, traffic, transit, and emergency service agencies. Participating agencies have access to data from all other agencies via a secure web-based interface. Information service providers and the public have limited access to data sets through data feeds and a public information website. RIITS information currently includes freeway and arterial data, freeway travel time estimates, changeable message sign data, CCTV data, arterial signal timing data, incident reports, event and lane closure data from Caltrans, and transit vehicle location and route data. Participating agencies include LA Metro bus and rail operations; LADOT; Caltrans Districts 7, 8, and 12; CHP; Foothill Transit; and Long Beach Transit. An interface allows RIITS to communicate with the IEN.

Section 6: Related Projects or Programs

Caltrans Projects and Programs:

Mobility Pyramid: In addition to Caltrans' 2007 Strategic Plan which outlines the ITS technologies required to meet Caltrans' mobility and safety goals, Caltrans also promotes its "mobility pyramid" that emphasizes intelligent transportation systems, traveler information, traffic control, and incident management as one of the six strategies Caltrans will pursue to achieve the outcome of reduced congestion. The Southern California Association of Governments (SCAG) adopted an identical pyramid in 2012 as a part of its own Regional Transportation Plan. The Mobility Pyramid stresses the need to preserve, maintain, and optimize the existing transportation system before investing in more costly capital expansion projects.

Transportation Concept Report (TCR) for I-210: The TCR for the I-210 was prepared by Caltrans District 7 in June 2003. The Report serves as a long range (20 years or more) planning tool that identifies current operating conditions, future deficiencies, a target level of service (LOS) for each segment in the route, and improvements needed to sustain or reach those targets. The I-210 TCR identifies the CC Pilot area as Segments 4, 5, and 6 with AM and PM peak levels of service F1, F2, and F1, respectively. Since District 7 has established the minimum acceptable service level to be F0, the entire CC Pilot area falls below the threshold that is considered to provide adequate transportation opportunities. This corridor was further predicted to get worse by 2020. Even with the TCR recommendation of adding a second HOV lane for the entire length of the I-210 (with 2020 demand), only half of the eight segments were expected to meet or exceed the LOS F0 minimum. In the CC Pilot area, Segments 4 and 5 would improve to LOS F0 and F1, respectively, while Segment 6 would still decline to LOS F2. The TCR is a reminder that freeway expansion alone is not only a costly option but also not enough to keep up with ever-increasing capacity demands.

Ramp Metering Program: Over the years, Caltrans has used traffic metering on ramps and freeway connectors as an effective freeway management strategy. The ramp metering program is now an integral part of Caltrans' system management concept and is used to help reduce congestion and increase safety on the state's highway system. Within the program, each Caltrans district is responsible for assessing the need and performance of ramp meters, as well as responding to ramp metering complaints and inquires. District 7 currently maintains over 1,000 metered on-ramps and freeway-to-freeway connector meters, making it the largest Caltrans ramp metering district. Two projects executed under this program will provide valuable lessons learned and support to the CC Pilot. The first is the 2001 System Wide Area Ramp Metering (SWARM) project, which saw the development and deployment of new control algorithms designed to adjust the ramp metering rates to observed congestion on the freeway along a section of I-210 corridor. The 2009 Congestion Relief Project further saw the installation of meters on the I-605/I-210 and SR-57/I-210 freeway-to-freeway connectors and the activation of additional on-ramp meters along I-210, bringing the total number of active on-ramp meters along I-210 to 54, and the development and testing of improved ramp metering algorithms.

ICM Exploration Projects: Two projects recently initiated by Caltrans, in collaboration with other regional partners, are seeking to assess the feasibility of integrated Caltrans ramp-metering with the operation of other traffic control systems. The first project, initiated in 2012 and known as the Dynamic Corridor Ramp Metering System (DCRMS), is seeking to develop a framework for integrating data from nearby traffic signals into the ramp metering decision-making process. A second project, known as the South Bay Corridor Study and Evaluation for Dynamic Corridor Congestion Management (DCCM), aims to identify and evaluate proactive congestion

management concepts that would allow Caltrans to make the fullest use of existing system capacities to address the congestion that the South Bay region of Los Angeles County is expected to face over the next ten to twenty years. This project is focused on the improvement potential that may be obtained from coordinating freeway ramp metering systems with nearby Caltrans and local arterial traffic signal systems.

Active Traffic Management (ATM) Congestion Relief Study: Caltrans District 7 recently initiated an investigation into the feasibility of implementing dynamic traffic management strategies in District 7. While Caltrans has already successfully employed some ATM strategies in the district (such as a part-time shoulder HOV lane on SR-118, part-time HOV lanes on SR-14, and adaptive corridor ramp metering on I-210), Caltrans is interested in expanding the types of strategies being employed to help proactively manage traffic in congested areas. Strategies being investigated include speed harmonization, queue warning, junction control, dynamic re-routing and traveler information. The study will aim to establish a framework for decision-making on how to proceed with the implementation of ATM strategies. This will include establishing guidelines and methodologies for decision support, supporting the analysis of candidate strategies, and understanding how to determine which strategies would be beneficial for different types of operating conditions and locations.

Travel Times on Changeable Message Signs: Caltrans recently started posting the estimated time to key nearby destination(s) on freeway changeable message signs. Travel times are estimated using traffic flow data collected from freeway mainline traffic sensors. While many signs display a single travel time to a specific location along the freeway, an increasing number signs are being used to display comparative travel times to a specific destination using alternate routes, such as the travel time to downtown Pasadena via I-10 and I-210.

In addition to the related Caltrans projects/programs noted above, there are Caltrans initiatives at the statewide level that also relate to the CC Pilot and ICM California:

Caltrans Initiative	***Brief Overview***	***Relationship to CC Pilot and/or ICM California***
Strategic Growth Plan (SGP)	The SGP presents a bold vision of mobility improvements and investments. The initiative is performance-based and outcome-driven, targeting significant reduction in congestion, improved quality of life for Californians, and a world-class transportation system that supports a globally-competitive economy and promotes prosperity.	The CC Pilot also includes mobility improvements and congestion relief goals.
Smart Mobility Framework	Emphasizes travel choices, healthy and livable communities, reliable travel times for people and freight, and safety for all users.	Connected Corridors can help reach the Smart Mobility Framework goals by reducing vehicle miles traveled and delay, and improving safety by decreasing accidents.
Complete Streets	Complete Streets is defined as a transportation facility that is planned, designed, operated, and maintained to provide safe mobility for all users, including bicyclists, pedestrians, transit riders, and motorists. Successful long-term implementation of the Complete Streets policy will result in: more options for people to go from one place to another, less traffic congestion and greenhouse gas emissions, more walkable communities, and few barriers for older adults, children, and people with disabilities.	The CC Pilot will provide better transportation options for people and reduce traffic congestion and greenhouse gas emissions.
Corridor System Management Plans (CSMP)	CSMPs are comprehensive plans for increasing transportation options, decreasing congestion, and improving travel times in a transportation corridor. A	The I-210 CSMP provides a wealth of data and information about the corridor to the project team. This data may not otherwise be available or may take additional project

	CSMP covers all travel modes and is developed by Caltrans in partnership with regional and local partners. In September 2010, a CSMP was completed for the "Los Angeles I-210 Corridor." The focus of the CSMP was a 20-mile urban section of the I-210 from SR-134 to SR-57, approximately the same section that is the focus of the CC Pilot.	resources to gather. Additionally, the CSMP helped forge many of the partnerships that help make the I-210 corridor an ideal choice for the CC Pilot.
California Transportation Plan 2025	The California Transportation Plan 2025 is a "policy plan designed to guide transportation investments and decisions at all levels of government and by the private sector to enhance our economy, support our communities, and safeguard our environment for the benefit of all."	Connected Corridors and ICM California are in direct alignment with the Plan's vision which states: *"California has a safe, sustainable, world-class transportation system that provides for the mobility and accessibility of people, goods, services, and information through an integrated, multimodal network that is developed through collaboration and achieves a Prosperous Economy, a Quality Environment, and Social Equity."* The CTP's four guiding principles are also aligned with the philosophy of planning and implementing Connected Corridors throughout the state: *Collaboration, Leadership, Innovation, and Communication*.
Ramp Metering Development Plan (RMDP)	See Section 6.	

Caltrans Partner Projects and Programs:

Los Angeles County Regional ITS Program: Established in 2005 and operated by LA Metro, the Los Angeles County Regional ITS Program operates and maintains the RIITS Network. The Network and Program provide valuable information to assist with system performance evaluations, planning and policy analysis, and traffic management improvements for the Network's many transportation and transit partners, including Metro. The Program has accomplished system redundancy to ensure the network is able to provide continuous congestion and incident data in support of Los Angeles County's 511 traveler information program. In 2009, Metro committed over $36 million to the operation and expansion of the Program in their Long Range Transportation Plan (LRTP). Potential enhancements identified in the LRTP include real-time data archiving, multi-modal corridor performance measurement and evaluation, travel forecasts, goods movement and incident management applications and network integration with neighboring counties.

Metro's Arterial Improvement Programs: Metro's 2009 LRTP also outlines their continued commitment to improving arterial traffic flow through capital improvements and advanced technology. Metro provides funding to local governments to complete major arterial projects and maintain or expand signal synchronization programs. Metro, in partnership with the LACDPW, is also one of the primary funders of the County's Information Exchange Network (IEN) which allows for the collection and distribution of arterial traffic data to facilitate better signal management and interagency coordination. Furthermore, the 2009 LRTP promotes bus signal priority systems that can integrate with regional traffic management systems.

Transportation System Management (TSM) Funding and ITS Architecture:

- The Southern California Association of Governments (SCAG) is a national leader in ITS deployment with extensive ITS investments and new technology applications. The 2012-2035 Regional Transportation Plan (RTP) dedicates over $7 billion to TSM and ITS technologies for the five-county region. The CC Pilot includes five of the seven TSM categories supported by the RTP: enhanced incident management,

advanced ramp metering, traffic signal synchronization, advanced traveler information, and improved data collection. In 2011, SCAG updated its Southern California Regional ITS Architecture to reflect changes in the National ITS Architecture and newer technologies. Topics covered in the 2011 update include express lanes, traveler information, data exchange, and goods movement. System components are expected to be designed according to established system architectures.

- Metro's 2009 LRTP outlines their continued pursuit of TSM strategies in addition to constantly improving Los Angeles County's public transportation system. The thirty year plan dedicates $862 million to transportation system management programs that range from synchronizing and optimizing signal timing including a bus signal priority program, better coordination and data sharing among jurisdictions, and IEN and Automated Traffic Surveillance and Control system (ATSAC) investments. The 2009 Plan also supports continued development of ITS technologies that monitor real-time traffic flow and congestion points on freeways, and inform the traveling public about congestion locations and alternate routes. Metro, as the Regional Transportation Planning Agency (RTPA), allocates funding for TSM for Los Angeles County.

Section 7: Vision, Goals, Objectives, and Activities and How the Grant will Accelerate or Facilitate the Achievement of the Overall Vision

Vision:

The Connected Corridors project, with a consortium of partners, will utilize new paradigms in cooperative traffic management to more effectively move vehicles and people.

Goals and Objectives:

- GOAL 1: Address and fundamentally change the way the State of California manages its transportation challenges; and foster positive, collaborative, ongoing corridor system management practices
  - Develop an initial set of proactive system management protocols, standard operating procedures, and action plans
  - Promote agency coordination and new technologies to relieve congestion
  - Implement traffic management policies that utilize integrated corridor management tools and intelligent transportation systems to improve mobility
- GOAL 2: Bring together corridor stakeholders to create an environment for mutual cooperation, including sharing knowledge, developing working pilots, and researching and resolving key issues
  - Engage all corridor stakeholders through meetings and workshops to build consensus on how to improve corridor system performance
  - Provide stakeholders with new technologies and systems to improve long term collaboration and knowledge sharing
  - Develop playbooks with stakeholders to manage congestion
- GOAL 3: Improve mobility, safety, efficiency, and the environment; and decrease congestion in California's most congested corridors
  - Develop and deploy an integrated, advanced decision support system for use by the stakeholders as they actively manage the corridor
  - Reduce rear end collisions and improve major freeway incident response times

- Provide better travel time information to drivers to encourage the use of transit and multimodal travel resulting in increased in transit ridership
- Improve travel time reliability and reduce travel delay

- GOAL 4: Demonstrate project effectiveness that can lead to additional phases and funding, and measure pilot performance outcomes to help future transportation performance-based decision making in the state and across the U.S.
  - Use clear, measurable objectives to quantify the successes and performance of the CC Pilot
  - Document all methodologies and action steps along with resulting outcomes and findings to show pilot success and so pilot can be replicated in other corridors
  - Maintain Connected Corridors website to serve as a resource for future ICM projects

Key Project Milestones:

The key upcoming activities (milestones) include the following:

- Develop User Needs – February/March 2014
- Final Project Management Plan – March 2014
- Risk Management Plan – April 2014
- Continue Stakeholder Engagement; Signed Letter Agreement with Key Stakeholders – June 2014
- Preliminary System Concept – August 2014
- Draft Memorandum of Understanding – September 2014
- Concept Exploration – October 2014
- System Engineering Management Plan – November 2014
- Draft Concept of Operations – January 2015
- Identification of System Requirements – mid-2015
- Key Institutional and Organizational Changes to Support the Future Deployment of the Pilot – mid-2015
- System Design, Development, Integration, Deployment, and Validation – 2015/2016
- User Training – Mid-2016
- One Year System Evaluation – November 2016 to October 2017
- Identification of Lessons Learned and Best Practices – October 2017

The ICM Deployment Planning Grant funds will allow the Systems Engineering process to continue for the CC Pilot and will facilitate/accelerate the Vision, Goals, and Objectives as follows:

A. Allow Caltrans to change its internal structure to better manage corridor projects (both for the CC Pilot and in up to 50 congested corridor segments throughout the state)
B. Continue the process of the stakeholders working together to move vehicles and people in the corridor
C. Develop an advanced decision support system (DSS) to deploy on the I-210; evaluate, refine, and use the DSS on other corridors in the state
D. Demonstrate CC Pilot effectiveness and measurable benefits so that future ICM California phases can be funded and replicated

Section 8: Project Key Performance Measures and Success Factors

The key performance measures and success factors are summarized in the table below. The performance measures are consistent with those identified in the I-210 Corridor System Management Plan. Additionally, the performance measures are in alignment with the FHWA Transportation Performance Management strategic approach to achieve national performance goals and subsequent FHWA MAP-21 Performance Measures.

PERFORMANCE MEASURES	DESCRIPTION
Mobility – Moving people and freight in the I-210 corridor	Using PeMS data and probe data from relevant sources, the delay on the I-210 will be evaluated after the pilot has been initiated and compared to the historical PeMS data for the mainline freeway and the HOV lanes to determine improvements in the number of people and vehicles (including trucks) traveling through the corridor. Arterial traffic data will also be compiled to assess the number of vehicles using the arterials parallel to the I-210 as diversion routes during significant events.
Reliability – Travel time predictability along the I-210 corridor	Using PeMS data and probe data from relevant sources, weekday travel times before and after the CC Pilot is deployed will be estimated and compared to historical data to determine improvements in travel time reliability along the mainline freeway lanes, HOV lanes, and parallel arterials.
Safety – Collisions, injuries, and fatalities occurring in the I-210 corridor	Using TASAS (freeway) data from Caltrans, the number and severity of accidents, and the number of fatalities will be noted both before and after the CC Pilot has been initiated. Arterial accident and fatality data will be collected from the corridor cities, if possible.
Productivity – Bottlenecks or hot spots that reduce flow rates on the I-210 corridor	PeMS data will be used to identify the bottlenecks affecting the I-210 freeway following the CC Pilot initiation and to measure the resulting peak period traffic flow rate (in vehicles-per-hour-per-lane) on the most congested freeway segments. Comparison will also be made to similar data that was measured for the I-210 CSMP. Depending on the availability of supporting data, arterial evaluations will seek to determine changes in the number and location of intersections having a v/c ratio exceeding a certain threshold (indicating limited capability to accommodate additional demand).
Emissions and fuel consumption – Greenhouse gas (GHG) emissions in the I-210 corridor	The South Coast Air Quality Management District (SCAQMD) and California Air Resources Board (CARB) will be consulted for GHG emission data and analysis methodology to determine GHG emission reductions that may be a result of the CC Pilot.
SUCCESS FACTORS	
Stakeholder lines of communication established and continuing	Document the stakeholder identification and engagement process, the number of meetings, and the meeting participants for the CC Pilot (through surveys or other means). Also document other outreach strategies used and the recommended on-going communications plan once the CC Pilot has started.
Transit ridership increases	Document the bus and light rail mode shift changes, as well as the increase in parking at transit stations in the I-210 corridor.

Accident and delay reduction	Document the reduction in the number and severity of accidents and the reduction in delay in the I-210 corridor before and after the CC Pilot has been implemented.
Increased travel time reliability	Document the improvements to travel time reliability after the CC Pilot has been implemented.
Additional funding for ICM California to expand the CC Pilot to other congested corridors	Grant applications written and accepted for funding to expand the CC Pilot to additional corridors in the state and then nationwide.
CC Pilot is used by other State DOTs	Notification that State DOTs are using the CC Pilot model; partnership agreements with other State DOTs.

Section 9: Initial Scope and Funding Request

The scope of this ICM Deployment Planning Grant includes the preparation of the ICM Analysis, Modeling, and Simulation (AMS) Plan for the CC Pilot. The funding request is $200,000, with matching funds of $50,000, making the total project amount $250,000.

The CC Pilot is following the systems engineering process that was introduced to the Intelligent Transportation Systems (ITS) community in the mid-1990s. In the systems engineering "V-Diagram," up-front planning and system definition are emphasized prior to technology identification and implementation. Therefore, user needs, system operations, and system requirements are initiated first. The CC Pilot team is currently in the process of drafting the Project Management Plan, Risk Management Plan, and Concept of Operations (ConOps). Two meetings are scheduled for the first quarter of 2014 to identify the user needs to form the basis of the ConOps. The draft ConOps will be submitted to FHWA for review and approval prior to FHWA reimbursement for work on the AMS Plan. The V-Diagram for the CC Pilot (illustrated below) overlays stakeholder outreach and communications for the entire process, as stakeholder involvement is critical to the success of the project.

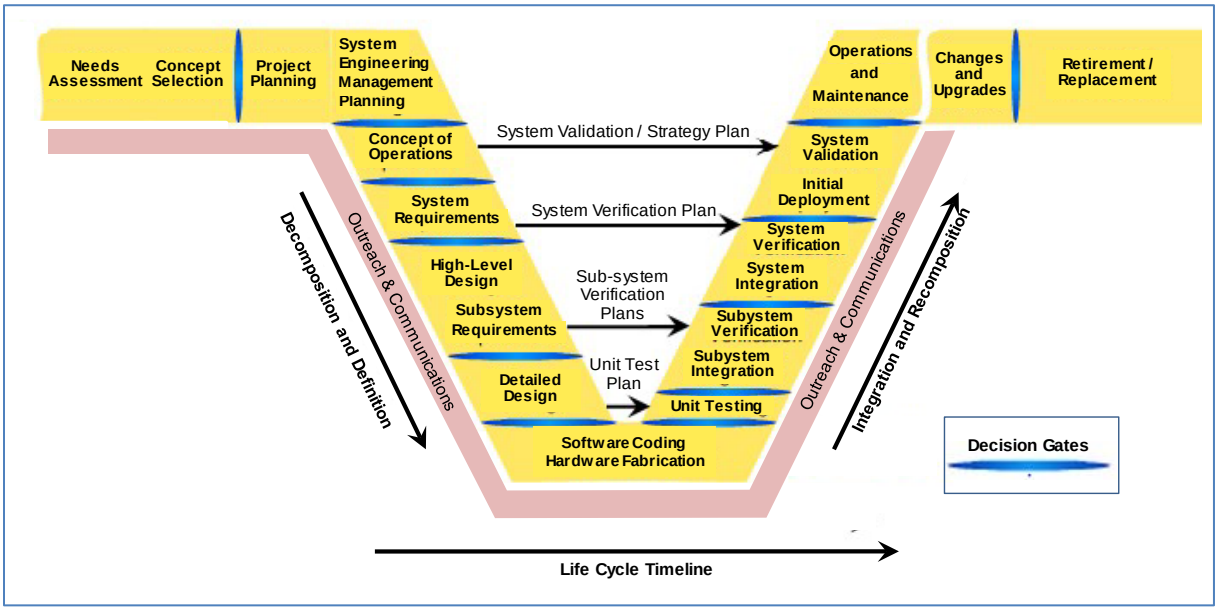

Figure 6: The V-Diagram for the CC Pilot

The AMS Plan will be developed concurrently with the ConOps and the System Engineering Management Plan (SEMP). The AMS Plan will be a living document that it will be updated as assumptions change and new information is learned. It will also be used to document all changes made throughout the analysis. The following is a summary of the activities required for preparation of the Analysis, Modeling, and Simulation Plan (each task is detailed in the text following the summary):

Summary Activities for the Analysis, Modeling, and Simulation Plan

Step 1: **Prepare the CC Pilot Introduction and Initial Project Scope**

- Subtask A: Overview and I-210 Corridor Demographics
- Subtask B: Project Background and Guiding Principles
- Subtask C: Project Goals and Objectives

Step 2: **Describe the CC Pilot Corridor and the Existing Operational Conditions**

Step 3: **Develop Analysis Scenarios and ICM Strategies**

- Subtask A: Develop analysis scenarios based upon the I-210 Information
- Subtask B: Compare and contrast alternatives with the ICM strategies
- Subtask C: Ensure that scenarios take into account the widest range of operational conditions
- Subtask D: Confer with corridor stakeholders
- Subtask E: Rank scenarios
- Subtask F: Start the process of scoping assumptions and identifying opportunities and constraints
- Subtask G: Prepare an initial Summary of ICM Priority Strategies based on Subtasks A through F above

Step 4: **Identify Data Needs and Availability**

Step 5: **Define Output Performance Measures**

Step 6: **Determine AMS Tools and Methodology**

Step 7: **Prepare Summary Analysis**

Step 8: **Describe the AMS Approach**

Step 9: **Summarize the Model Calibration Process**

Step 10: **Develop Timeframe and Roles**

Step 1: Prepare the CC Pilot Introduction and Initial Project Scope

Subtask A: Overview and I-210 Corridor Demographics

This section defines the corridor boundaries, jurisdictional environment, transportation systems (freeways, arterials, transit, parking, etc.), trip generators (commercial and industrial areas, schools, medical centers, etc.), transportation management assets (TMCs, incident/event systems, traveler information, etc.), and current operational status (travel demand and freeway, arterial, transit operations as well as jurisdictional collaboration) of the I-210.

Subtask B: Project Background and Guiding Principles

This is a brief description of the project background, including the rationale for investing in ICM which will assist in engaging stakeholders and gaining support for the project. The importance of stakeholder involvement and the change management process that will take place throughout the development and

implementation of the AMS will be discussed. The background of Caltrans and UC Berkeley/PATH's involvement in ICM and ITS will also be highlighted.

Subtask C: Project Goals and Objectives

The goals and objectives for the AMS effort will be married with the overall goals and objectives for the CC Pilot. They will be consistent with the ConOps, since they are being developed concurrently.

Step 2: Describe the CC Pilot Corridor and Existing Operational Conditions

The corridor assessment will include a complete description of the corridor and document existing traffic conditions such as: average daily and peak traffic levels, traffic directionality and variability, corridor construction projects, bottlenecks, queuing conditions, free flow and average peak speeds, and incident and accident statistics. The outcome of this assessment will be a refined problem definition which the CC Pilot will work to solve. The information gathered in the corridor assessment can then be used to develop analysis scenarios, as outlined in the next task.

Step 3: Develop Analysis Scenarios and ICM Strategies

Subtask A: Develop analysis scenarios based upon the I-210 geographic scope, infrastructure, facilities, recurrent and non-recurrent congestion causes, incident details and response protocols, etc.

Subtask B: Compare and contrast the alternatives with the ICM strategies proposed in the ConOps. Modify or develop new alternatives as necessary.

Subtask C: Ensure that scenarios take into account the widest range of operational conditions possible including weather, work zones, special events, etc.

Subtask D: Confer with corridor stakeholders often during the process to obtain consensus on scenarios, alternatives, and operational conditions unique to the I-210.

Subtask E: Rank scenarios by greatest frequency and greatest impact to determine which scenarios will be included in the Plan or dismissed.

Subtask F: Start the process of scoping assumptions and determining opportunities and constraints associated with the application of ICM strategies identified under specific operating conditions; consult with corridor managers (both freeway and arterial).

Subtask G: Prepare an initial Summary of ICM Priority Strategies based on Subtasks A through F.

Step 4: Identify Data Needs and Availability

This step includes exploring data needs and sources for the AMS Plan and ultimately the Data Collection Plan, taking into account data and information previously collected on the I-210. Technical meetings with the corridor cities are currently underway, and the cities are providing lists of data and sources. Ideally, data from multiple sources will be collected for the same time period. Information such as the time period and format of the data, time lags in data, reliability, and any known data quality issues will also be addressed during this step.

Step 5: Define Output Performance Measures

The performance measures for the CC Pilot will be documented in order to determine how the corridor will be operated as a system rather than as individual parts. The performance measure metrics will also be drafted. In addition to specific measures that are identified for the I-210 corridor (for example, safety improvements), four key ICM performance areas will be considered: Mobility, Travel Time Reliability and Productivity, Emissions and Fuel Consumption, and Benefit/Cost Estimates.

Step 6: Determine AMS Tools and Methodology

This task will explore and select the appropriate AMS approach and tool type(s). Key components of the process include: researching and identifying available analysis tools and models for the I-210; analyzing the key factors that will affect the selected tools; and finally, selecting the appropriate tool type(s).

Step 7: Prepare Summary Analysis

In this step, a summary analysis will be completed which identifies the I-210 corridor model assumptions and inputs. This analysis will provide the preliminary guidance to the modelers. Later in the process, these assumptions will need to be validated with traffic data and before-after traveler surveys.

Step 8: Describe the AMS Approach

A summary will be prepared of the CC Pilot team's planned approach for conducting the AMS, as well as the model calibration approach. The modeling tools, the baseline networks and years, the analysis periods (such as time of day), and the future forecast networks and years will all be outlined in the summary. A flow chart of the analysis methodology and approach will be drafted for the project stakeholders.

Step 9: Summarize the Model Calibration Process

Planning and documenting the model calibration process will be a critical step in the AMS. This step will involve communication between the CC Pilot management, stakeholders, and the technical team regarding the process and criteria that will be used to calibrate the model.

Step 10: Establish Timeframe and Stakeholder Roles

This step includes the identification of roles and responsibilities of the I-210 team (specifically as it relates to the AMS), establishing a timeframe for completing the AMS Plan and other key documents being prepared concurrently (i.e., the ConOps), and drafting a schedule of stakeholder meetings and presentations regarding the AMS Plan. The CC Pilot Stakeholder MOU will be drafted during this step to formally document established roles and responsibilities.

Related Plans and their relationship to the AMS Plan:

Project Management Plan	Drafted; final 1st Q 2014
Risk Management Plan	1st Q 2014
System Engineering Management Plan	Late 2014
ConOps	Concurrent (draft by January 2015)

Section 10: ICM Analysis, Modeling, and Simulation Plan

The ICM Analysis Modeling and Simulation Plan for the I-210 Connected Corridors Pilot will be prepared with the funding from this ICM Deployment Planning Grant. The ConOps has been initiated and will be completed concurrently with the AMS Plan. The ConOps will be submitted to the FHWA for review and approval.

Section 11: Organizations and Key Staff Involved; Estimated Costs; Funding Sources

Part A: Organizations and Key Staff Involved:

Organization	*Key Staff*	*Key Role*
Caltrans Headquarters	Joan Sollenberger	Provide direction; administrative and management oversight.
Caltrans Headquarters	Nicholas Compin	Contract compliance, grant management, administrative and management oversight; lead staff for Connected Corridors statewide.
Caltrans District 7	Sam Esquenazi	Leadership and day-to-day management for the overall CC Pilot.
UC Berkeley/PATH	Alexandre Bayen	Co-Principal Investigator for the Connected Corridors project at PATH. Oversees the project research; responsible for successful completion of the project.
UC Berkeley/PATH	Roberto Horowitz	Co-Principal Investigator for the Connected Corridors project at PATH. Oversees the project research; responsible for successful completion of the project.
UC Berkeley/PATH	Joseph Butler	Management of PATH resources; works with stakeholders to ensure pilot and ICM California's success; responsible for development of the DSS.

Figure 7 below is the current Team Organizational Chart for the CC Pilot:

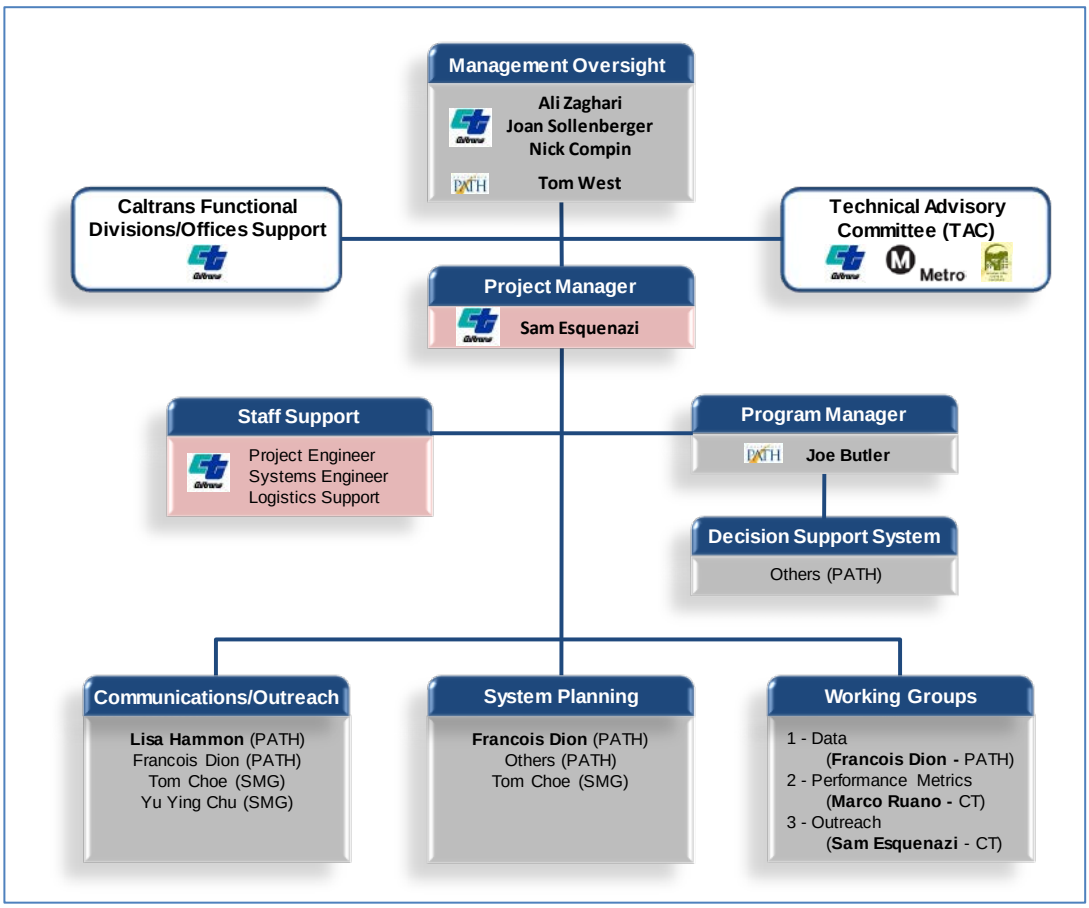

Figure 7: Team Organizational Chart

Part B: Estimated Costs:

Task	Cost Estimate
CC Pilot AMS Plan Research	$70,000
• Scope	
• Existing Conditions	
• Data Needs and Availability	
CC Pilot AMS Plan Technical Work	$100,000
• Analysis Scenarios	
• AMS Tools and Methodology	
• AMS Approach	
• Model Calibration Process	
• Timeframe and Roles/Responsibilities	
CC Pilot AMS Plan Document Preparation	$50,000
• Writing, Editing, Final Plan	
Stakeholder Meeting Travel	$10,000
• Quarterly Stakeholder Meetings (or more often if necessary) to Discuss Data, Performance Measures, Tools and Methodology, AMS Approach, Timeline	
CC Pilot Support and Administration	$20,000
• Meeting Preparation, Notes, Follow Up	
• Management and Travel Support	
TOTAL	**$250,000**

Part C: Funding Sources:

1. FHWA ICM Deployment Planning Grant - $200,000
2. Caltrans ICM 1 Project Funds - $50,000

Part D: Key Party to the Award/Contracting Entity:

Caltrans Headquarters, Office of Strategic Development, is the key party to the award and the entity that will be entering into the agreement with FHWA. The primary contacts are:

- Dr. Nicholas Compin, Connected Corridors Statewide Project Manager, Office of Strategic Development, Division of Traffic Operations. Phone: 916.651.1247; Email: nicholas.compin@dot.ca.gov.
- Joan Sollenberger, Chief, Office of Strategic Development, Division of Traffic Operations; and Statewide Connected Corridors Program Manager. Phone: 916.653.4575; Email: joan.sollenberger@dot.ca.gov.
- Caltrans Headquarters address is: PO Box 942873, Sacramento, CA 94723-0001

Part E: Processing/Managing the Program Funds

The program funds will be managed by Dr. Compin (see above) and supported by the Caltrans Procurement and Contracts Department. Dr. Compin has experience managing large, complex grants with multiple funding sources and compliance with invoicing procedures and progress reports. The Procurement and Contracts Department provides services in the areas of procurement, publications, warehousing, service contracts, architectural and engineering contracts, minor public works contracts, and all emergency force account contracts for phase one emergencies that immediately restore services. The two departments – Traffic Operations and Procurement and Contracts – have a good working relationship and will ensure that the processing and management of the grant funds follow all guidelines, rules, and regulations.

Section 12: Conclusion

The I-210's performance issues, coupled with its parallel arterials and existing traffic management tools, make it an ideal candidate for the ICM Deployment Planning Grant funding and the CC Pilot. While individual traffic management efforts have helped some cities in the corridor, they remain limited by the funds and physical boundaries of their individual jurisdiction. A collaborative approach, addressing congestion for the entire corridor, is the next logical step to improve mobility for the region.

The CC Pilot will look at the whole system, not just individual components. Previous efforts have slowed congestion and made isolated improvements; however, a cohesive system does not exist. Without addressing traffic on both the freeway and arterials, improvements to one component are not necessarily reflective of real travel time improvements. The CC Pilot will connect the individual stakeholders and work to build consensus on how to address congestion for the betterment of the entire network.

Congestion doesn't just impact a region's overall quality of life, it also impacts the economy. A recent study by the McMaster Institute for Transportation and Logistics suggests that job growth slows when a commuter spends

more than 35 to 37 hours delayed in traffic per year. The average Los Angeles commuter spends 61 hours in traffic delays per year, second in the nation and almost double the threshold for slowed job growth from the McMaster study. In 2011, the greater Los Angeles area also had the worst travel time index of any major metropolitan area (1.37) and the second worst congestion cost per auto commuter ($1,300). Unreliable travel times impact buses equally, if not more than cars, and can result in drivers being less willing to switch to transit. Free-flowing HOV lanes and transit signal priority are two strategies the CC Pilot will use that specifically target reliability for buses and carpool vehicles.

Integrated Corridor Management (ICM) addresses many of the performance issues occurring in the I-210 corridor: recurrent bottlenecks, vehicle and transit delays, travel time reliability, and incident avoidance/management. The CC Pilot will investigate all ICM strategies with the region's stakeholders and implement those shown to be the most beneficial for the corridor. From traffic management strategies spanning multiple jurisdictions, to changeable message signs encouraging drivers to switch to transit or less congested routes, to faster incident response times, the CC Pilot's collaborative approach will work to improve mobility on multiple fronts and create a more efficient transportation system for the entire corridor.

Funding for preparation of the System Engineering documents – specifically the Analysis, Modeling, and Simulation (AMS) Plan – will assist in moving the project forward and meeting the project goals, as well as goals defined in the U.S. DOT's Integrated Corridor Management Systems Initiative. Without the funds from the ICM Deployment Planning grant, the system engineering process will be delayed by a minimum of one year, the stakeholders' commitment will be lost, and congestion on one of the most congested freeways in the Los Angeles region will continue indefinitely.

Section 13: Basic Approach for Phase 2

Phase 2 of the CC Pilot would include preparation of the Data Collection Plan and actually collecting the data, described in more detail in the following outline:

- Identify all available data in the I-210 corridor (including, but not limited to, PeMS data and probe data) and any data gaps.
- Develop procedures for data quality control and archiving.
- Collect data including existing model and GIS information, information on all transportation modes in the I-210 corridor, gather any previous studies (in addition to those already collected for Phase 1, including the CSMP), conduct field reviews of the transportation modes in the corridor; collect manual data (if required).
- Write the Existing Conditions Report for the I-210 corridor.
- Archive and maintain the datasets and all other critical information.
- Draft and finalize the Data Collection Plan.

In Phase 2, particular attention will be paid to data quality, the collection of data on the same dates and at the same times, understanding how the datasets will be used to focus on recurrent versus non-recurrent congestion, specific issues that may arise during the data collection process, and traveler response data (such as route diversion or route changes due to incentivization).