Connected Corridors
Face-to-Face Meeting

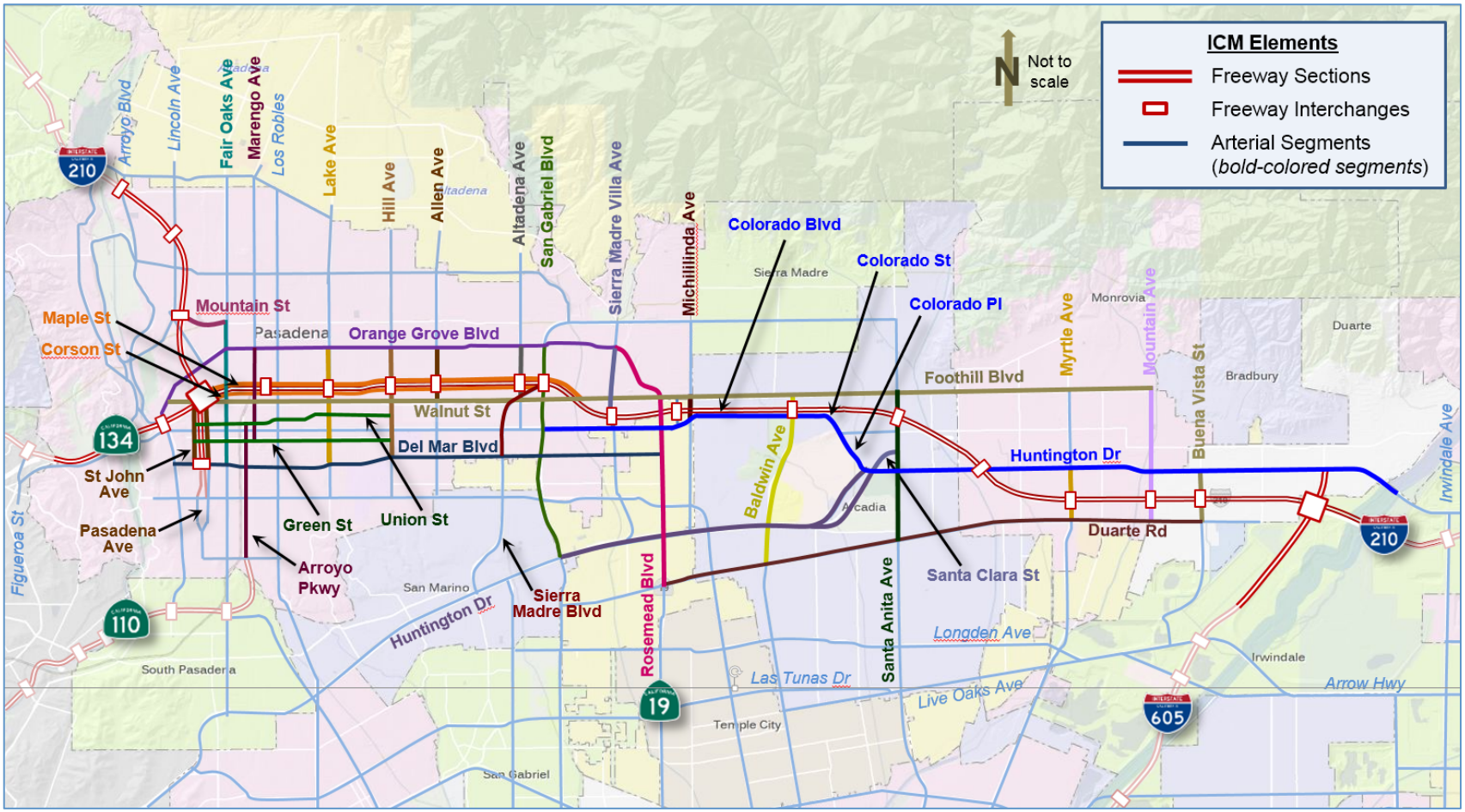
Tuesday, June 7th, 2016 – 1:30 – 3:30 pm
Caltrans D7 HQ

June 7th, 2016

Agenda

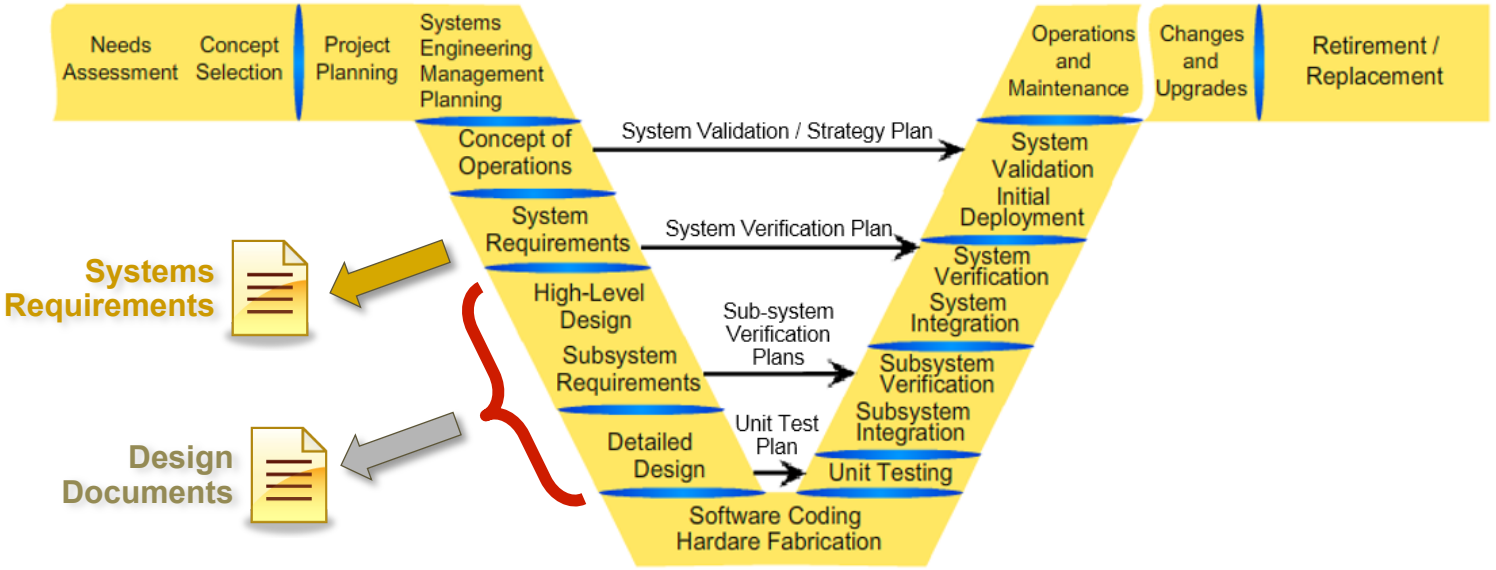
- Introductions
- Quick Summary
- Schedule Update
- Outreach and new ATCMTD Proposal
- Infrastructure – SHOPP and Metro Funded Project Details
- Requirements Update
- High Level Design and Caltrans Update
- AMS and Response Plan Design
- Action Items and Closing

Our Corridor: The I-210



Systems Engineering Next Steps

- **Systems Requirements – What should the ICM system do**
- **Design Documents – How will the requirements be met**

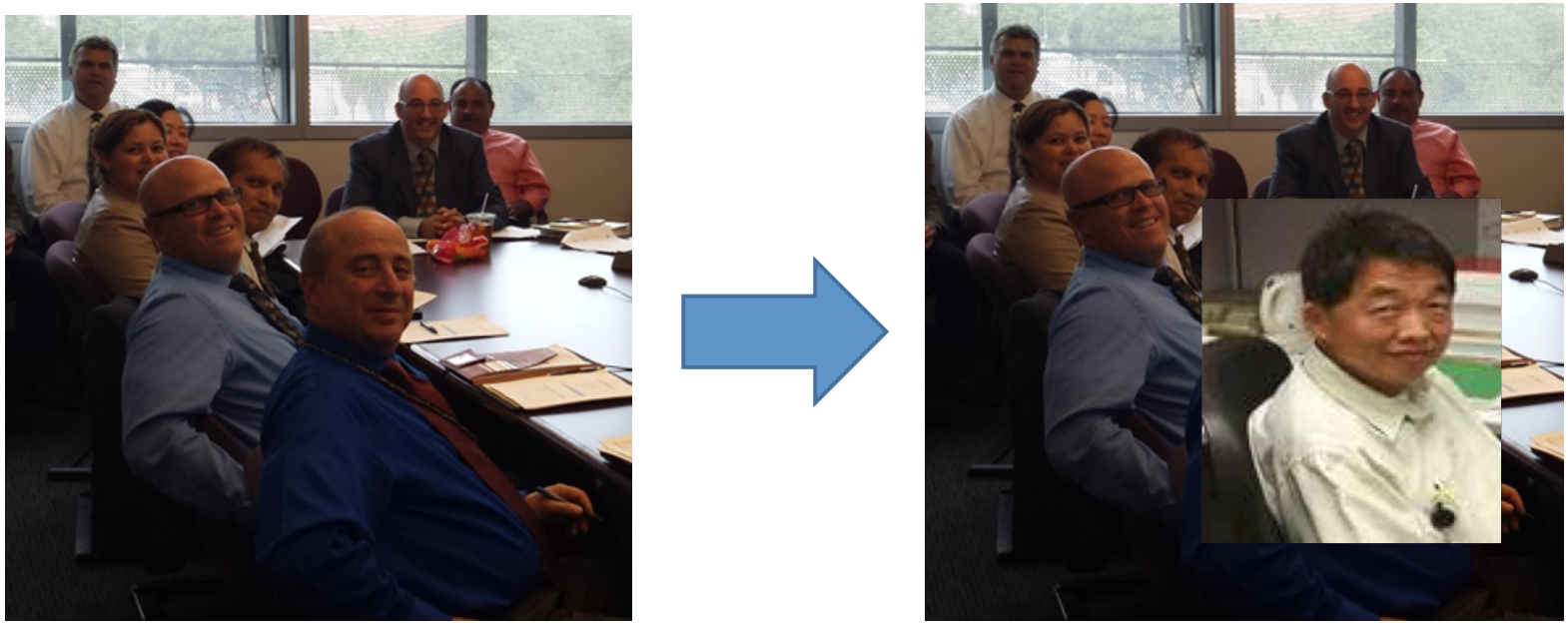


Quick Summary

Leadership Transition – Joan to Nick

- Nick is now – Chief, Office of Strategic Development
- Previously Nick:
  - Managed the PEMS system
  - Worked in the Director's Office and at the CTC
  - Worked in District 3 in Modeling and Forecasting
  - Received a Ph.D. from UC Irvine

Leadership Transition – Sam to Allen



- We will miss Sam and know that he will be thinking about us every day….
- Welcome to Allen Chen
  - Allen has many years of experience working on and leading IT projects
  - Allen's leadership of the LARTMC project is an impressive accomplishment
  - Allen will be able to combine work on the ATMS, DCCM, CC and other systems

Quick Summary – Last Meeting was March 8th

- **Outreach**
  - Connected Newsletter, meeting with MTC/D4/HQ, web site updates
  - ATCMTD Proposal
- **Requirements**
  - All comments reviewed – Next version nearing completion. Anticipate next week.
- **Infrastructure Improvements**
  - Call for Projects inventory being refined. Start date delayed by two months.
  - I-210 SHOPP program beginning construction
- **Architecture and High Level Design**
  - High Level Design has begun – Diagram to be shown today
  - Good meetings with Caltran's HQ and D7 personnel
- **AMS/Response Plan Generation**
  - Good progress on Corridor Model and Response Plan Rules

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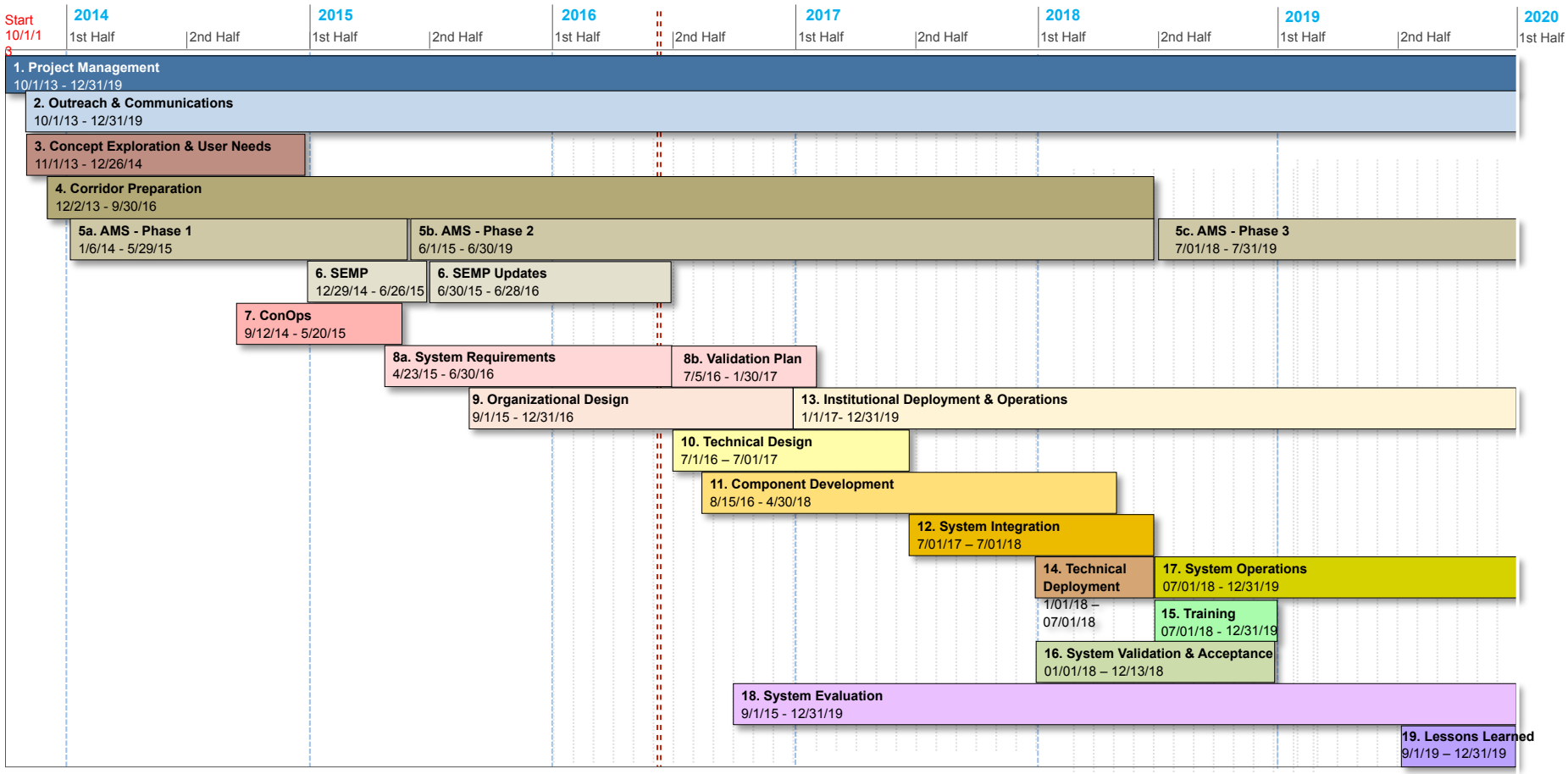
Schedule Update

Schedule


Start 10/1/13
2014
1st Half
2nd Half
2015
1st Half
2nd Half
2016
1st Half
2nd Half
2017
1st Half
2nd Half
2018
1st Half
2nd Half
2019
1st Half
2nd Half
2020
1st Half
1. Project Management
10/1/13 - 12/31/19
2. Outreach & Communications
10/1/13 - 12/31/19
3. Concept Exploration & User Needs
11/1/13 - 12/26/14
4. Corridor Preparation
12/2/13 - 9/30/16
5a. AMS - Phase 1
1/6/14 - 5/29/15
5b. AMS - Phase 2
6/1/15 - 6/30/19
5c. AMS - Phase 3
7/01/18 - 7/31/19
6. SEMP
12/29/14 - 6/26/15
6. SEMP Updates
6/30/15 - 6/28/16
7. ConOps
9/12/14 - 5/20/15
8a. System Requirements
4/23/15 - 6/30/16
8b. Validation Plan
7/5/16 - 1/30/17
9. Organizational Design
9/1/15 - 12/31/16
13. Institutional Deployment & Operations
1/1/17- 12/31/19
10. Technical Design
7/1/16 – 7/01/17
11. Component Development
8/15/16 - 4/30/18
12. System Integration
7/01/17 – 7/01/18
14. Technical Deployment
1/01/18 – 07/01/18
17. System Operations
07/01/18 - 12/31/19
15. Training
07/01/18 - 12/31/19
16. System Validation & Acceptance
01/01/18 – 12/13/18
18. System Evaluation
9/1/15 - 12/31/19
19. Lessons Learned
9/1/19 – 12/31/19

Schedule Updates

- **New Launch Date for Connected Corridors - July 2018**
- **Infrastructure work on corridor**
  - SHOPP – To be completed by mid-2018
  - Metro Call for Projects Improvements - To be completed by late 2018

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Outreach

Spring Connected Newsletter

Connected

Spring 2016

A Quarterly Newsletter for Connected Corridors Stakeholders

Update

The fall and winter months have been busy for the CC Pilot and for national transportation issues. In October, CA Assemblymember Jim Frazier visited UC Berkeley to learn about its various transportation institutes and projects including the CC Pilot (see page 3). In December, President Obama signed the FAST Act into law, marking the first long-term transportation bill passed by Congress in 10 years (see page 6). For the Pilot, both the CC Docs website and the CC website were updated (see page 5). In January, Connected Corridors was once again represented at the Transportation Research Board's annual conference held in Washington D.C., where Dr. Francois Dion presented the Connected Corridors program and the I-210 Pilot on behalf of Caltrans and the entire team. Lastly, Mr. Homar Noroozi became the new Interim Principal Engineer at Caltrans District 7. Noroozi will be leading the implementation of District 7's organizational realignment concurrent with the development and deployment of TSMO strategies and ITS technologies. Welcome to the team, Mr. Noroozi!

Requirements Draft Ready for Review

After more than 20 meetings with over 75 stakeholders, the first draft of the Connected Corridors High-Level System Requirements document ("Requirements") is now being reviewed. This crucial document defines what the system and all its components—including people, organizations, software, and hardware—must do. While a lengthy and ambitious process, well-developed requirements create a strong foundation for the next step in the Systems Engineering process, system design, and ultimately help ensure the long-term success of the pilot.

"I am extremely grateful for every person who took the time to meet with us and work on these requirements," said Samson Teshome, Corridor Manager for Caltrans District 7. "It's a new process for many of our stakeholders, but with full engagement of our partners, I know we are on the path to success." One unique attribute of the CC requirements document is the three levels of detail, making it usable for a range of audiences. The three formats are:

- Brief summaries: primarily written for upper management and for inclusion in informational presentations.
- Generic explanations: place each requirement in the context of how things are going to be done, such as who carries it out, the skill set needed, how success is measured, maintenance required, degree of automation, and relation to other requirements. There is no mention of specific agencies, local data sources, or other I-210 Pilot-specific information, making it easier to modify for future pilots or for other agencies to use as a boilerplate.
- Requirements tables for the I-210 Pilot: contain the most detail, including corridor specifics, stakeholder agencies, and particular systems.

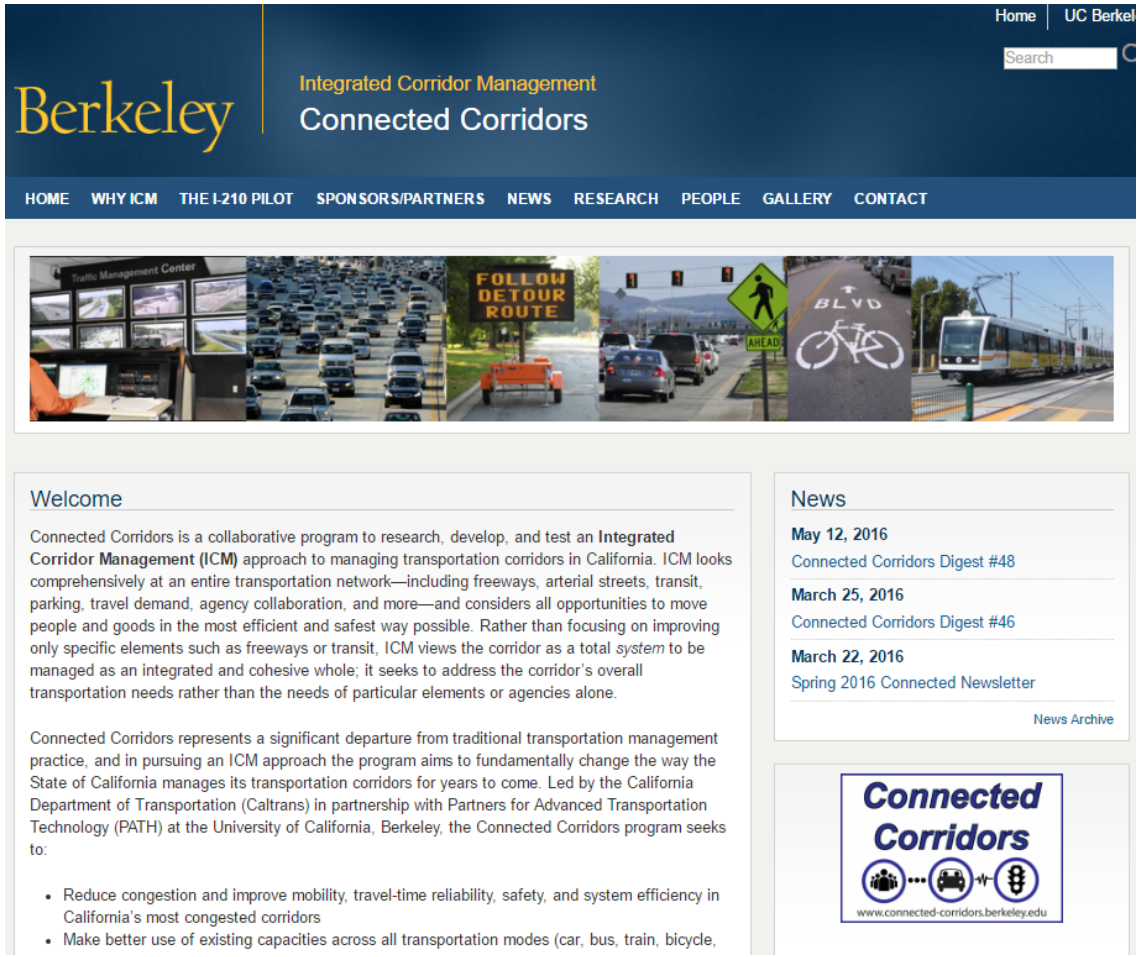
By providing the requirements in these varying levels of detail, the team hopes to address the many different expectations, experiences, and communication preferences found among the people who have been involved in the requirements process over the last six months.

Two key items included in the document are performance metrics and institutional requirements. For performance metrics, each requirement has a specific metric with the level of performance (the metric value) necessary for that requirement to be considered functioning or successful. For example, for Incident Detection

❍ Continued on page 2

Caltrans Metro County of Los Angeles City of Pasadena City of Arcadia City of Monrovia City of Duarte Southern California Association of Governments SGVCOG Foothill Transit California PATH

Updates to the Website



ATCMTD Proposal

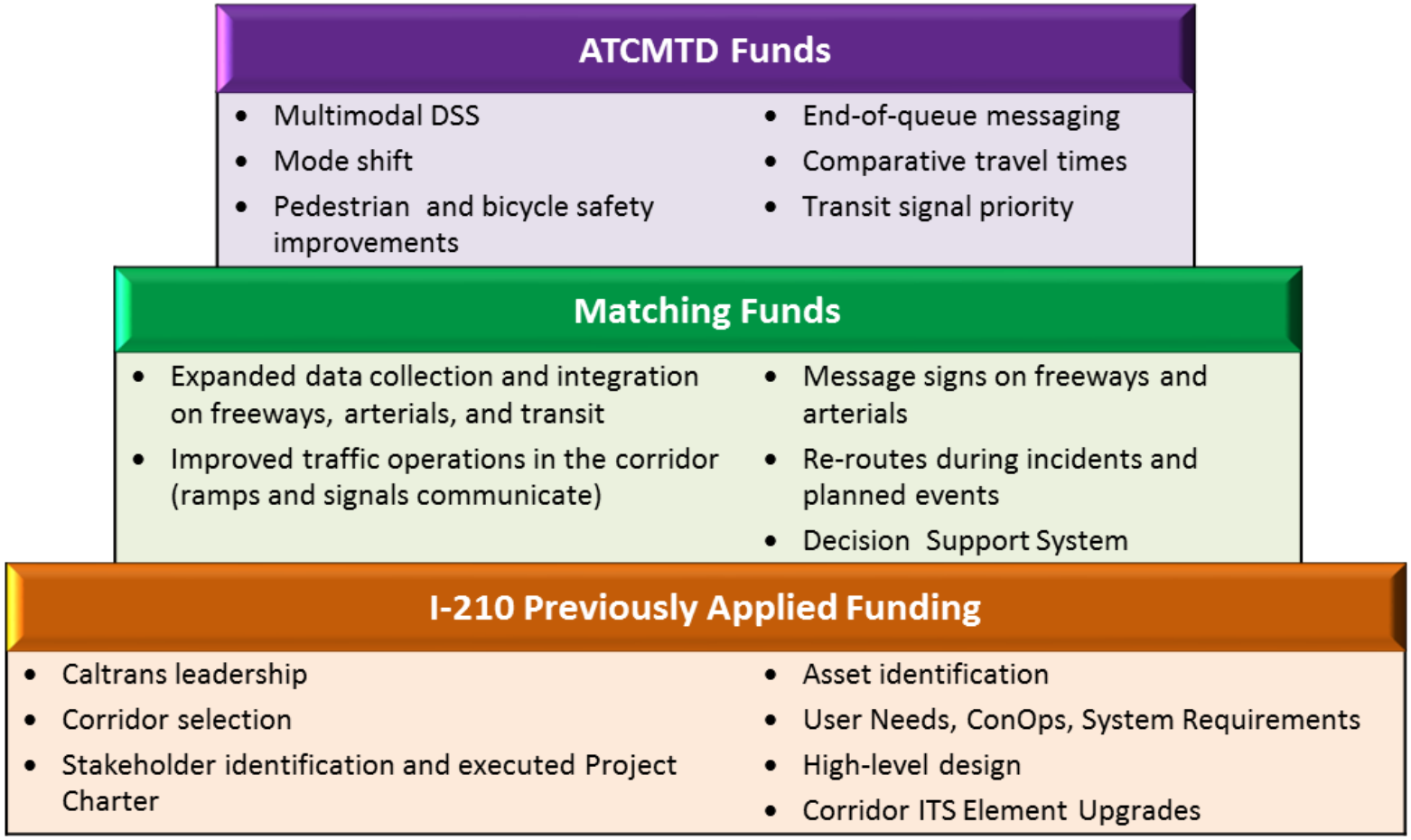
ATCMTD Proposal

- **ATCMTD - Advanced Transportation and Congestion Management Technologies Deployment Initiative**
- **USDOT - FHWA**
- **Up to $12 Million can be requested**
- **100% match is required**
- **1 to 4 year timeframe**
- **Heavily focused on deployment-ready requests**
- **Due June 24th**
- **Will be submitted by Caltrans D7**
- **Award to be made before the end of the year**

ATCMTD Connected Corridors Proposal

- **Expand the state-wide Connected Corridors program to be:**
  - Multimodal and demand management
  - Additional safety enhancements
- **We are asking for $9 Million with a $10 Million existing match = $19 Million**
  - ICM 2, LA Metro ITS Element Funding, SHOPP Funding
- **Includes new funding for:**
  - Management
  - Software
  - Hardware
  - Deployment
- **The proposal must be for $19 Million and thus includes I-210 Pilot work that is already planned**

Funding Allocation



Technologies and Strategies in Proposal

- Rerouting of autos, trucks, and buses around incidents and events
- Promoting mode shift towards transit, biking, and walking
- Enhancing safety
- Utilizing a Real-Time Multimodal Decision Support System (RTMDSS)
- Effectively inform travelers and operators
- Deploying transit signal priority
- Improving maintainability of ITS Elements
- Designing reusable system components

Selection Criteria

- **Technical Merit**
  - Alignment with program goals
  - Readiness of technology
  - Scalability and portability
  - Commitment to evaluate effectiveness
  - Clarity of proposal
- **Staffing**
  - Successful program management structure
  - Expertise and qualifications of key personnel

SHOPP Funds Update

I-210 Pilot – SHOPP Project Update

- EA 30640 – Freeway Improvements (SHOPP Project)
  - Finish Construction July, 2018
- Awaiting for a CPM schedule from contractor to determine when work up to the 605 will be completed
- Includes communication, signal upgrades, cameras, etc.

Metro Funded Projects Update

I-210 Pilot - Status Summary

- EA 32910 – Arterial Improvements (Metro Call for Projects)
  - Complete PSR-PR December, 2016
  - Ready To List December, 2017
  - Start Construction April, 2018
  - Finish Construction October, 2018
- LA County – IEN upgrade for the corridor
  - Schedule ?

Call For Projects

- **Review meeting held at Caltrans D7 to establish needs for PSR preparation**
- **Agency meetings held**
  - LA County
  - Arcadia/Monrovia
  - Pasadena
  - Duarte
- **Key findings:**
  - Some project scope elements have already been implemented through other agency projects
  - Replacement project elements supportive of the project have been requested
  - Specific location information still needed, e.g. for signs and detection

Summary of Issues raised at Agency Meetings (1)

- Signal Systems
  - LA County
    - KITS Data Collection already in place (-$600K)
    - No KITS interface to Omni-eX firmware needed (-$30K)
  - Pasadena Corridor Intersections:
    - QuicNet system (IEN connected)
    - Fair Oaks only SCATS (not to be IEN connected)
    - Caltrans intersections currently operated by the City: what will be the future arrangement?

Summary of Issues raised at Agency Meetings (2)

- Communications Improvements
  - Interconnect requests:
    - Arcadia network (tbd)
    - Duarte network ($300K)
    - Monrovia network ($250K)
  - Caltrans Fiber connect:
    - RIITS-IEN and IEN – TransSuite via (new) dedicated Caltrans fibers accessed at pullbox adjacent to CT intersection (Caltrans change order)
    - Caltrans reported that a RIITS networking solution is being considered for interconnecting systems
    - Monrovia/Duarte/Arcadia requesting fiber links to Caltrans for video sharing

Summary of Issues raised at Agency Meetings (3)

- Traffic Signal Controllers/Intersections
  - Arcadia:
    - Four controllers already replaced under other contracts
    - 2 new cabinets requested
  - County
    - Some controller upgrades already done
    - Controller (170 ATC) and Firmware upgrades (D4 and LACO4E) requested
  - Duarte
    - New Signal: Buena Vista/Central in Duarte
      - Work may be funded by Caltrans from a separate source (-$300K)
      - Funds would be re-allocated to support turning movement upgrades at intersections on Huntington Avenue (diversion route) (tbd)
    - Minor changes in firmware upgrades to match County policy (LACO4E and D4)

Summary of Issues raised at Agency Meetings (4)

- Traffic Signal Controllers/Intersections
  - Monrovia
    - One of 3 controllers already changed-out
    - Minor changes in firmware upgrades to match County policy (LACO4E and D4)
  - Pasadena
    - Requested 3 additional upgrades to controller cabinets and foundations

Summary of Issues raised at Agency Meetings (5)

- Intersection Detection Improvements
  - Arcadia:
    - 2 new Complex and 2 new 4-leg VIDS installations requested ($170K)
  - County
    - Largely within project scope
  - Duarte
    - Largely within project scope
  - Monrovia
    - Largely within project scope
  - Pasadena
    - Largely within project scope, locations to be confirmed by the City

Summary of Issues raised at Agency Meetings (6)

- Bluetooth Detection
  - Arcadia:
    - Add to existing server; largely within project scope
  - County
    - Largely within project scope
  - Duarte
    - Largely within project scope as part of County BT deployment
  - Monrovia
    - Largely within project scope as part of County BT deployment
  - Pasadena
    - Largely within project scope, locations to be confirmed by the City
    - Communications options to be explored (e.g. cellular vs hardwired)
    - Locations to be confirmed by the City

Summary of Issues raised at Agency Meetings (7)

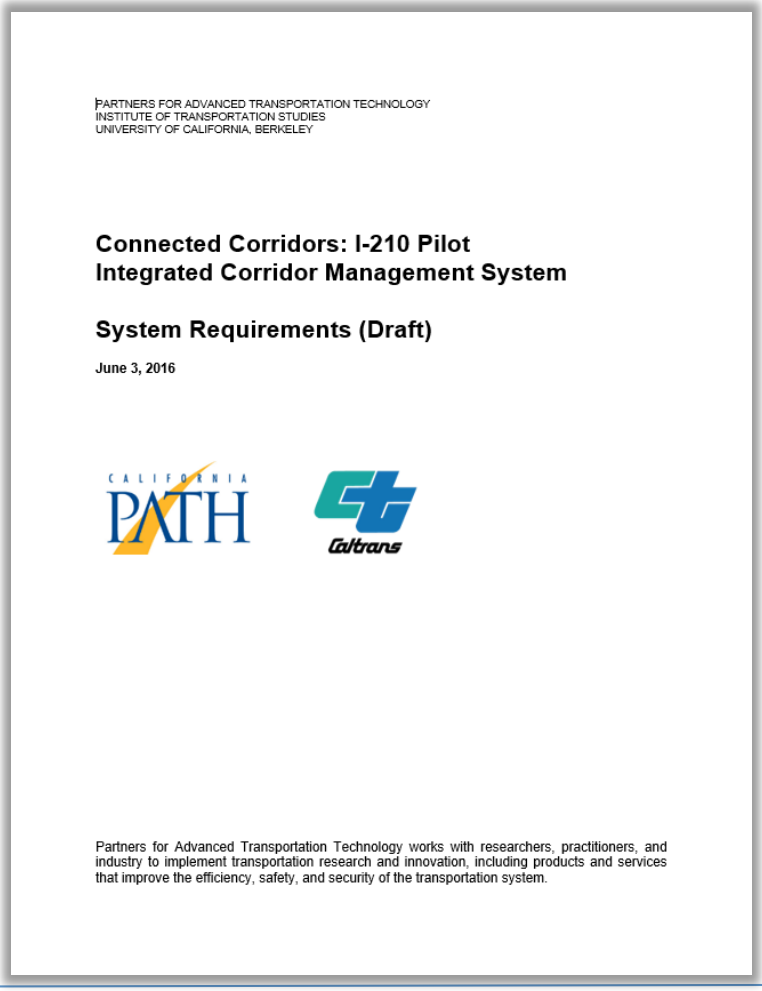
- Arterial Signing (locations tbd)
  - Arcadia
    - Preference for cellular communications; no mast arm mounts; AC power from luminaries
    - Requested control access for signs to be used in conjunction with special events
  - County
    - Supports limited (small) dynamic signing and static route identification
  - Duarte/Monrovia
    - No issues
  - Pasadena
    - Supports use of simple blank-out signs along the routes in stead of combined dynamic/static signing
    - Preference for AC power; permanent locations; mount on new poles
    - Raised concerns over O&M costs of cellular communications

Agency Meetings

- Open Issues:
  - Transit Agency System Interfaces
  - Transfer of BlueTooth data to ICM
  - Air Quality Sensors
    - Type
    - Cost
    - Location
- Next Steps
  - Collect location information
  - Validate cost estimates
  - Scope within budget

Requirements Definition

Requirements Document



PARTNERS FOR ADVANCED TRANSPORTATION TECHNOLOGY
INSTITUTE OF TRANSPORTATION STUDIES
UNIVERSITY OF CALIFORNIA, BERKELEY

Connected Corridors: I-210 Pilot
Integrated Corridor Management System

System Requirements (Draft)

June 3, 2016

Partners for Advanced Transportation Technology works with researchers, practitioners, and industry to implement transportation research and innovation, including products and services that improve the efficiency, safety, and security of the transportation system.

Requirements

- **We have completed processing 544 comments**
- **The next version of the requirements document will be ready in two weeks**
- **We still need to hold a meeting to review Caltrans comments with stakeholders**
  - Let's pick a date for that meeting

Summarized City and County Requirements

Sensing and Data	Incident/Event Response Plans	Road Network Management	Outreach, Agreements, Funding Personnel
To the extent possible, Cities shall communicate special events, street closures and recommended detour information to the CM that may affect traffic operations on identified detour routes. Caltrans shall disseminate information.	Cities will assist the CM in defining and maintaining rules for building response plans, handling special situations, messages to be displayed on CMS signs, selecting response plans and sending response plans to corridor assets.	Cities shall permit the Core ICM System, using the cities' signal control software, to select and implement preapproved signal plans for intersections on preapproved detour routes.	Cities shall remain engaged, attend meetings and/or teleconferences, and meet quarterly or as needed regarding incident/event responses
Cities shall maintain up-to-date definitions/ inventory of arterial network elements	County, in consultation with cities and Caltrans, will create and maintain coordination timing plans for use during incidents. Cities and/or county shall load the timing plans onto the controller for use during an incident.	The cities shall permit the Core ICM System, using the CMS control software, to select and implement preapproved messages for display on preapproved detour routes. Cities shall be allowed access to the CMS control software to make changes within their jurisdiction.	Cities shall assist with editing, reviewing, and executing documents and agreements.
Cities shall communicate forthcoming approved/ pending changes in roadway geometry and operations affecting traffic conditions, restrictions, and traffic control devices on designated arterials to the CM	Where possible, the ICM system shall determine the end-time of a city initiated incident/event. Where not possible, the cities shall indicate when an incident/event has terminated or is expected to terminate. The ICM system determination may be over-ridden by the City.	The cities shall permit the Core ICM System, to contact designated city personnel with requests for performing preapproved actions	Cities shall provide updated information on City contacts. Caltrans shall disseminate information.
Caltrans and cities shall work together to assist in resolving data, hardware, and software issues in a timely manner (the definition of timely manner will be determined at design time).	Caltrans CM, as necessary, will request meetings with cities in order to review rules used during incidents/events to determine if they worked correctly and, if they did not, resolve any issues	Overall ICM system will function correctly 85% of the time. • Signals 99% • Detection 85% • Communication 85% (70%-75%) • Software 95%	Cities will work with Caltrans to apply for federal, state, regional, and local funding sources.
Caltrans and cities shall ensure that system detection at key ICM arterial locations will be given priority maintenance. (Response time to be determined during design).		Stakeholder agreed to share video feeds as long as Caltrans' videos are not stored	ICM Steering Committee shall define roles, responsibilities, and reporting structures for the ICM system. Cities shall ensure key personnel and support personnel are in place and trained.

Caltrans Office of Technology

Caltrans Agreements

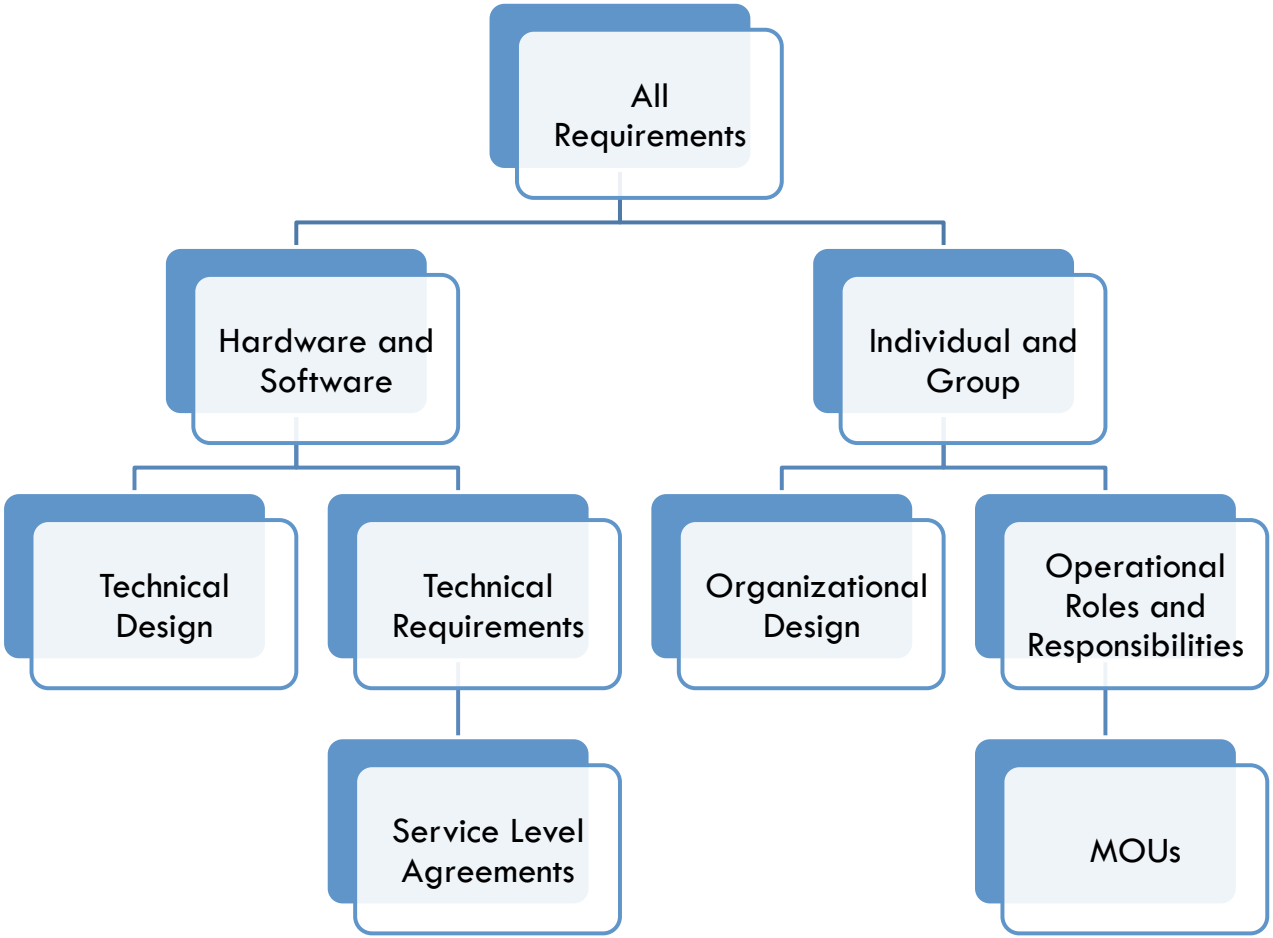
- Caltrans will start an IT Project to interface the CC system with the D7 ATMS
- Institutional and personnel requirements, identified in the CC requirements document, will be provided to Kimley Horn for inclusion in the document they are generating on needed KSAs.
- Caltrans will obtain licenses for data transformation and data storage functionality identified in the CC requirements document. These will initially run in the cloud and be usage license based.
- PATH, working with Caltrans, will engage commercial vendors in a proof of concept operation for certain CC functions.
- Caltrans will use these requirements to procure (in the cloud and on a usage license basis) COTS software
- Beginning in July, PATH will generate a gap analysis to identify missing components in the CC system implementation
- Caltrans will work with PATH to develop and present material describing the CC strategy and framework

Office of Technology

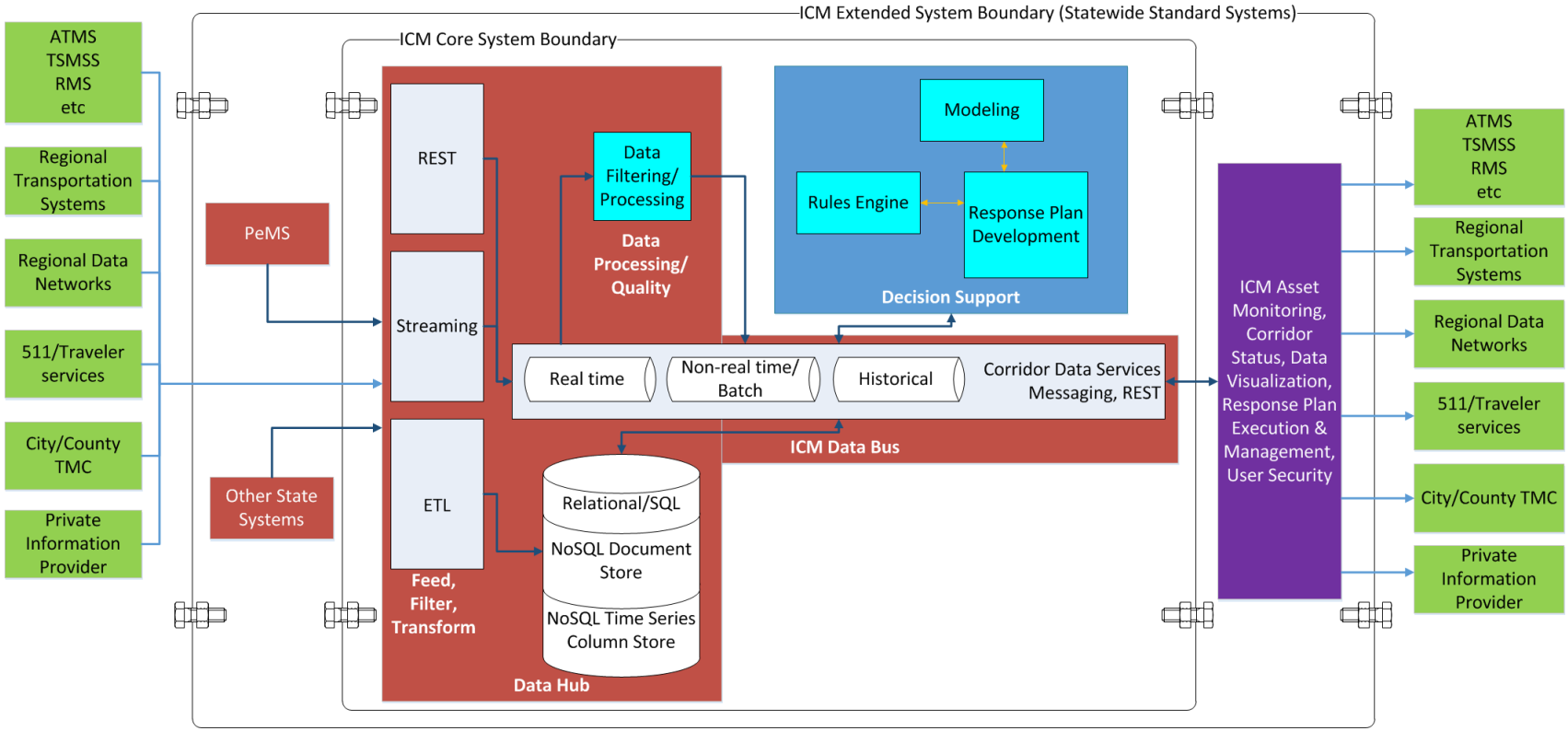
- Continued participation with the DCCM DSS RSCS
- Coordination meetings with HQ IT
- Research on Data Hub
- TMS Pilot Corridor Reporting Coordination

High Level Design

High Level Design



Current Proposed ICM Architecture



High Level Design – Gap Analysis

- **Map requirements to components**
- **Map components to owners who will provide the components**
  - Existing
  - Existing requiring modifications
  - New
- **Perform gap analysis**
  - Components with no owners
  - Components with owners but lacking resources to provide components

High-level Architecture

Cloud Computing

- Utilizes hardware and software hosted in large data centers
  - Traditionally organizations would buy hardware
  - Scaling up quickly was impossible and technology was soon outdated
  - Installation of new software required a long purchasing cycle

- The immense need for computing permits companies to offer computing by the minutes of CPU usage and the Gigabyte stored
  - Immediate scalability
  - Only pay for what you use
  - No hardware maintenance needed
  - Cost is highly competitive because of scale (Amazon, Microsoft, Google)

- This allows an organization to focus on business needs and less on IT

Data Quality

Is there data on the freeway?

Question: For a given week and sensor category, what percentage of sensors are providing data of any quality (good or bad)?

Weekly Average Data Quality	Eastbound I-210 Marengo/Corson to Sunflower Ave						Westbound I-210 Sunflower to Maple					
	Fwy-Fwy	Mainline	On Ramp	HOV	Off Ramp	Total	Fwy-Fwy	Mainline	On Ramp	HOV	Off Ramp	Total
Mar 6-12	0.0%	78.8%	95.0%	68.4%	69.0%	76.9%	62.5%	72.2%	95.2%	63.3%	79.8%	73.9%
Mar 13-19	0.0%	75.5%	92.5%	66.7%	67.0%	74.2%	62.5%	66.7%	92.1%	57.9%	73.4%	68.7%
Mar 20-26	0.0%	76.3%	91.9%	68.0%	69.0%	75.0%	62.5%	71.0%	96.8%	62.9%	77.8%	73.0%
Mar 27-Apr 02	0.0%	65.7%	74.5%	56.7%	56.7%	63.5%	53.6%	60.3%	80.4%	53.3%	68.5%	62.1%
April 3-9	71.4%	71.0%	75.8%	61.9%	61.0%	68.8%	62.5%	70.5%	88.9%	64.1%	71.9%	71.4%
April 10 -16	100.0%	82.2%	88.2%	74.0%	72.4%	80.5%	35.7%	77.0%	93.7%	68.7%	77.8%	76.4%
April 17 -23	100.0%	90.4%	90.1%	80.5%	72.9%	86.7%	62.5%	84.0%	93.1%	76.8%	76.8%	82.4%
April 24-30	100.0%	83.9%	85.7%	74.5%	73.3%	81.4%	35.7%	79.0%	94.7%	74.9%	79.8%	78.8%
May 1-7	100.0%	76.8%	85.7%	67.5%	73.3%	76.1%	42.9%	74.3%	90.5%	66.0%	77.8%	74.0%
May 8-14	100.0%	87.1%	81.4%	80.5%	73.3%	83.8%	33.9%	86.8%	92.1%	75.3%	78.8%	83.2%
May 15-21	100.0%	86.4%	83.2%	82.3%	72.4%	83.8%	25.0%	83.0%	87.8%	73.0%	74.9%	79.3%
May 22-28	100.0%	79.2%	89.4%	73.2%	73.3%	78.8%	25.0%	74.3%	86.8%	67.6%	76.8%	73.4%
May 29 - Jun 04	100.0%	68.6%	80.1%	64.1%	68.6%	69.4%	25.0%	69.8%	85.7%	61.8%	69.0%	68.8%

Answer: Provided by weekly summaries taken directly from PeMS detector health reports. (Calculated once a day and summarized)

Is there data on the arterial?

- **City of Arcadia**

Intersections			System Detectors		
Total	Detour Routes		Status	Total	
51	Yes	35	ON_LINE	407	434
			COMM_ERROR	23	
			COMM_ERROR/ON_LINE	4	
	No	16	ON_LINE	65	145
			COMM_ERROR	76	
			COMM_ERROR/ON_LINE	4	

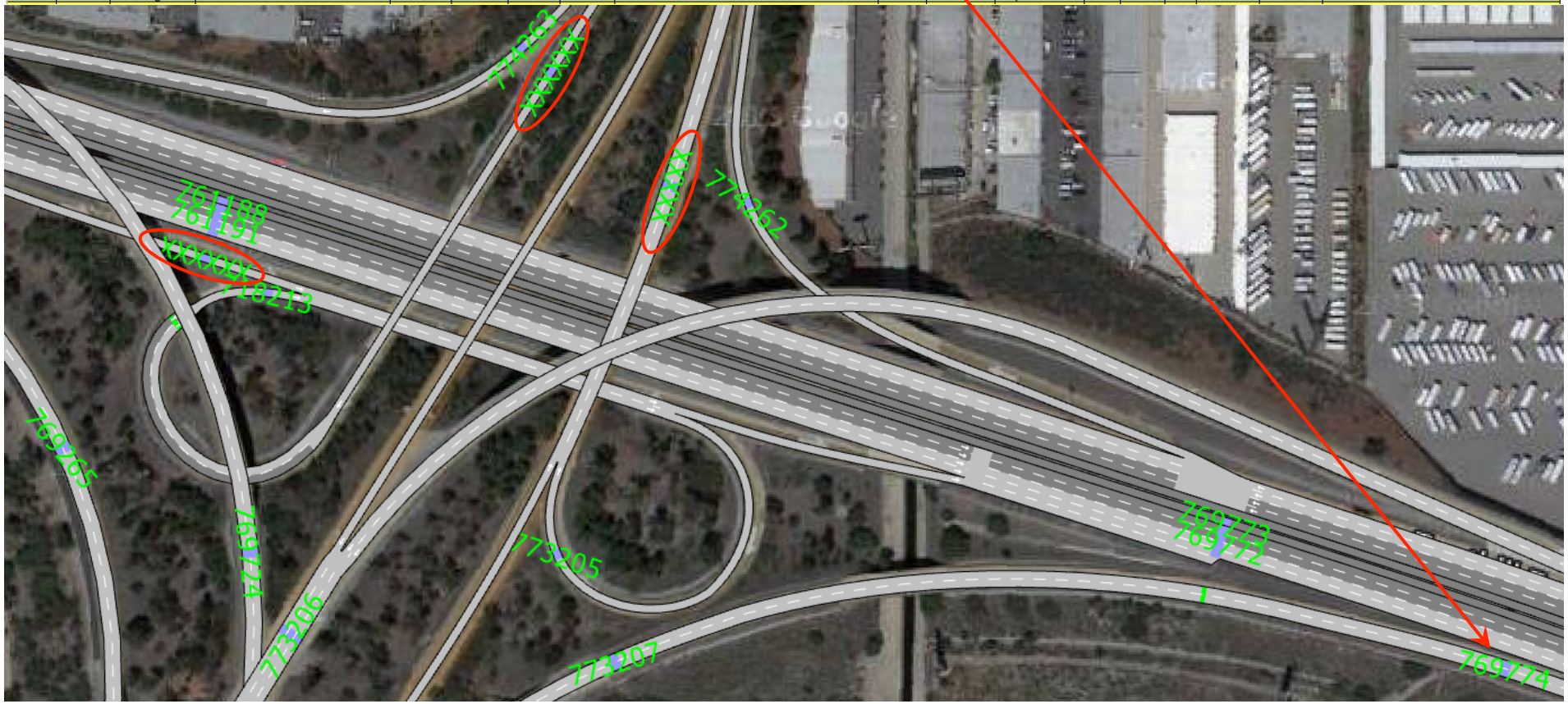
- **Detector health report**
  - Criteria:
    - Missing rate<5%
    - Inconsistency rate <15%
    - **Not reporting zero values (Major issue)**
  - Assessment: Good/ Bad/ No data
  - Can provide daily/weekly/monthly reports

Weekly Data Quality (%)	Arcadia					
	Detour Routes			Not Detour Routes		
	Good	Bad	No Data	Good	Bad	No Data
31-Jan-2016 To 06-Feb-2016	60.80	33.21	5.99	15.76	29.06	55.17
07-Feb-2016 To 13-Feb-2016	60.20	33.81	5.99	15.86	28.97	55.17
14-Feb-2016 To 20-Feb-2016	55.50	38.51	5.99	15.76	29.06	55.17
21-Feb-2016 To 27-Feb-2016	55.66	38.35	5.99	15.86	28.97	55.17
28-Feb-2016 To 05-Mar-2016	53.03	40.98	5.99	15.76	29.06	55.17
06-Mar-2016 To 12-Mar-2016	52.96	41.05	5.99	14.98	29.85	55.17
13-Mar-2016 To 19-Mar-2016	48.22	45.79	5.99	13.69	31.13	55.17
20-Mar-2016 To 26-Mar-2016	44.31	49.70	5.99	14.48	30.34	55.17
27-Mar-2016 To 02-Apr-2016	46.21	47.79	5.99	14.48	30.34	55.17
03-Apr-2016 To 09-Apr-2016	46.87	47.14	5.99	14.48	30.34	55.17
10-Apr-2016 To 16-Apr-2016	47.40	46.61	5.99	14.48	30.34	55.17
17-Apr-2016 To 23-Apr-2016	45.72	48.29	5.99	14.38	30.44	55.17
24-Apr-2016 To 30-Apr-2016	47.24	46.77	5.99	14.38	30.44	55.17
01-May-2016 To 07-May-2016	38.35	42.23	19.42	9.06	29.36	61.58
08-May-2016 To 14-May-2016	56.09	37.92	5.99	13.89	30.94	55.17
15-May-2016 To 21-May-2016	59.71	34.30	5.99	14.98	29.85	55.17
22-May-2016 To 28-May-2016	62.48	31.53	5.99	15.07	29.75	55.17

Freeway data PeMS configuration

50

Fwy	District	County	City	CA PM	Abs PM	Length	ID	Name	Lanes	Type	Sensor Type	HOV	MS ID	IRM	In Model	Lanes in Model	Comments
I210-E	7	Los Angeles	Duarte	R36.33	36.619	0.4	761191	MOUNT OLIVE DR / 605	4	Mainline	loops	No	4262		YES	4	
I210-E	7	Los Angeles	Duarte	R36.33	36.619	0.4	761188	MOUNT OLIVE DR / 605	1	HOV	loops	24H	4262		YES	1	
			Missing ramp from EB-210 to cloverleaf access				0	Missing ramp - cloverleaf access									
			Missing ramp from cloverleaf access back to EB-210				0	Missing ramp - cloverleaf access									
I210-E	7	Los Angeles	Duarte	R36.33	36.619		718213	MOUNT OLIVE DR / 605	1	On Ramp	loops	No	4262		YES	1	
I210-E	7	Los Angeles	Irwindale	R36.6	36.889	0.385	769773	NB 605 TO EB 210 CON	1	HOV	loops	24H	2416		YES	1	
I210-E	7	Los Angeles	Irwindale	R36.6	36.889		769774	NB 605 TO EB 210 CON	1	On Ramp	loops	No	2416		YES	2	Lane count mismatch
I210-E	7	Los Angeles	Irwindale	R36.6	36.889	0.385	769772	NB 605 TO EB 210 CON	4	Mainline	loops	No	2416		YES	4	Needs location and lanes verification
I210-E	7	Los Angeles	Irwindale	R37.1	37.389	0.45	772857	SAN GABRIEL RIVER	4	Mainline	loops	No	2119		YES	5	Lane count mismatch
I210-E	7	Los Angeles	Irwindale	R37.1	37.389	0.45	772859	SAN GABRIEL RIVER	1	HOV	loops	24H	2119		YES	1	

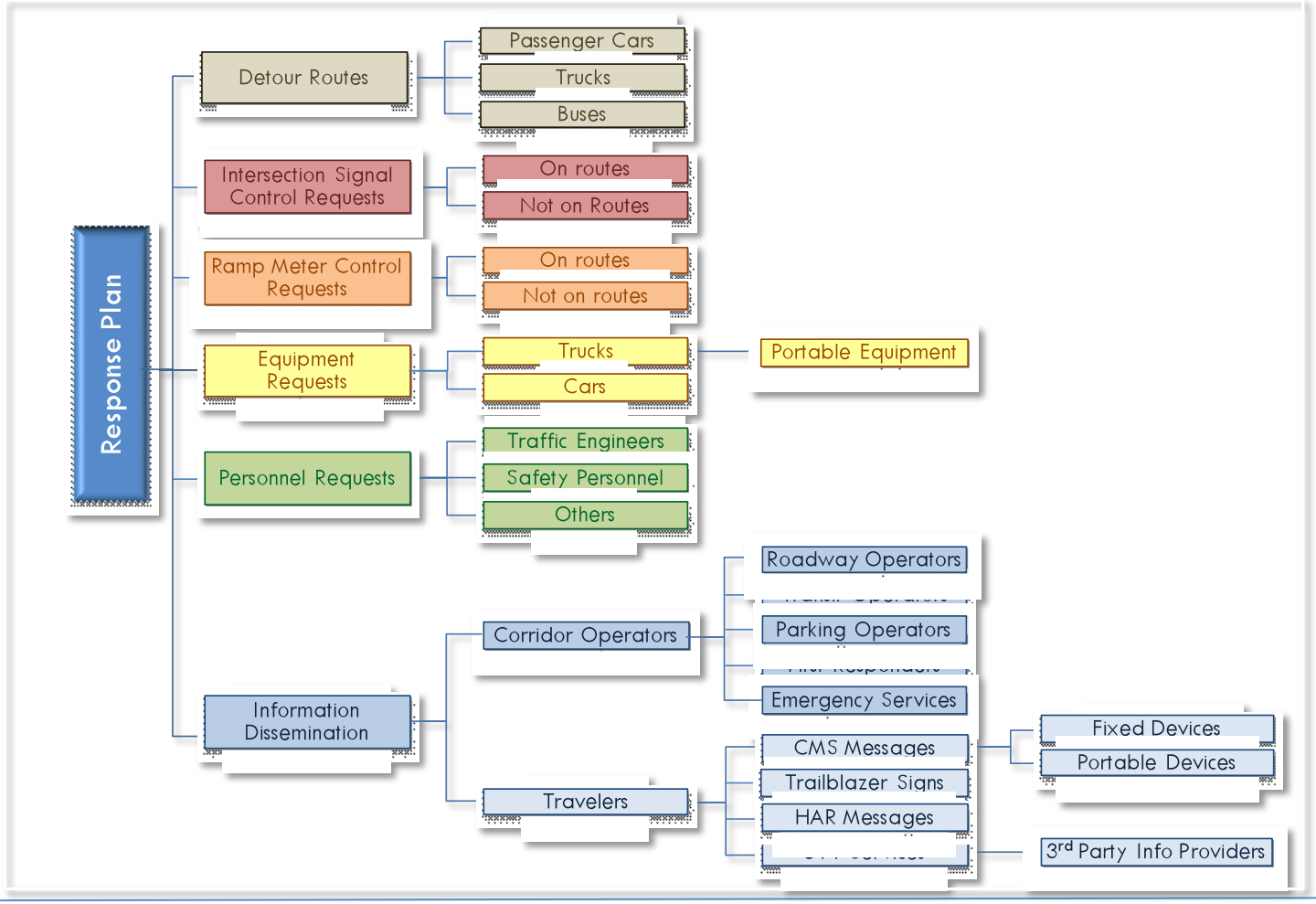


Response Plans

Response Plan Meetings

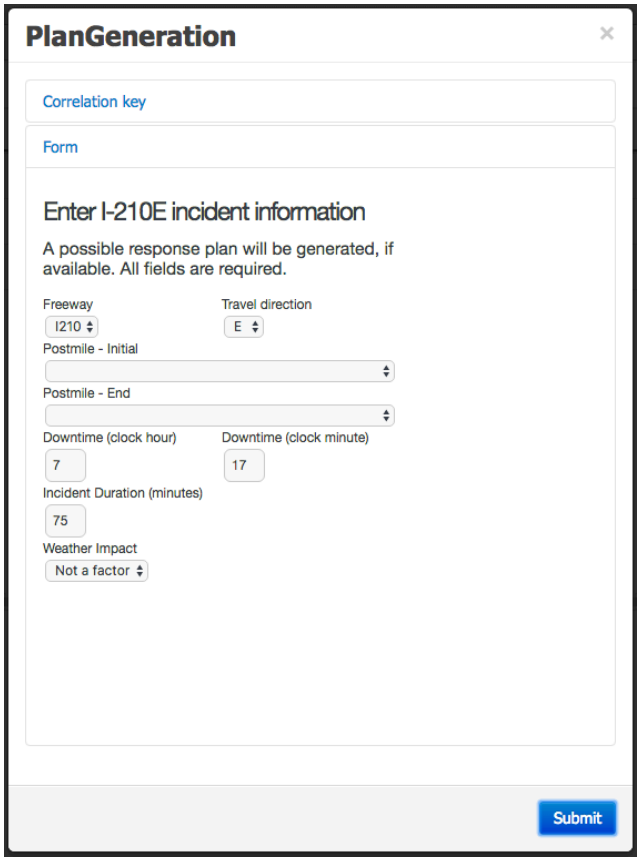
- **Caltrans HQ (including IT), Caltrans D7, PATH, System Metrics Group meet every 6 weeks to prepare for presenting initial response plans to cities and county.**
- **Next Meeting on June 30th**
- **We are:**
  - Utilizing modeling in order to run corridor wide simulations
  - Using synchro to develop response plan scenarios
  - Running data quality analysis
  - Capturing user defined rules

Response Plan Elements

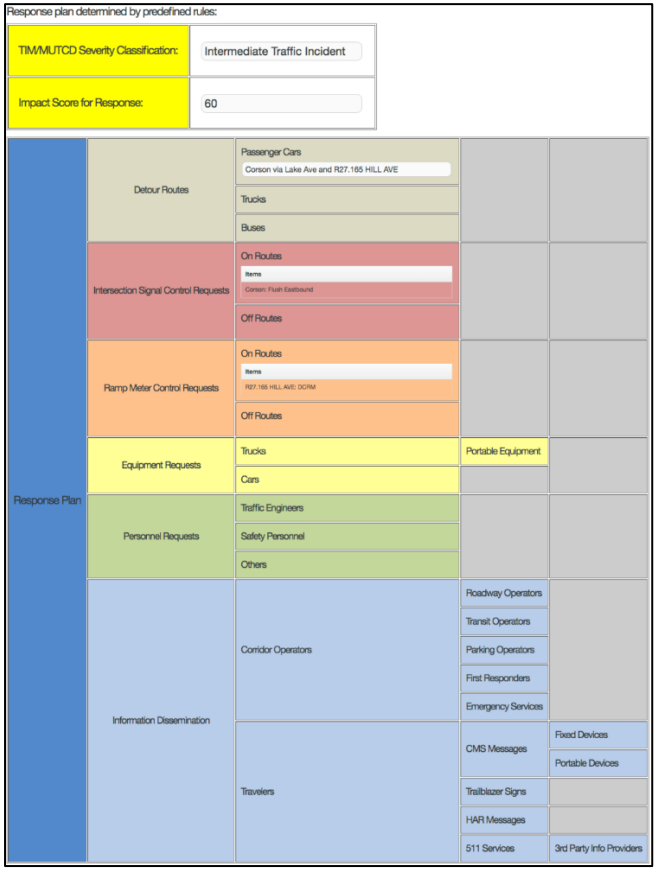


Response Plan Generation

Incident data entered by Operator

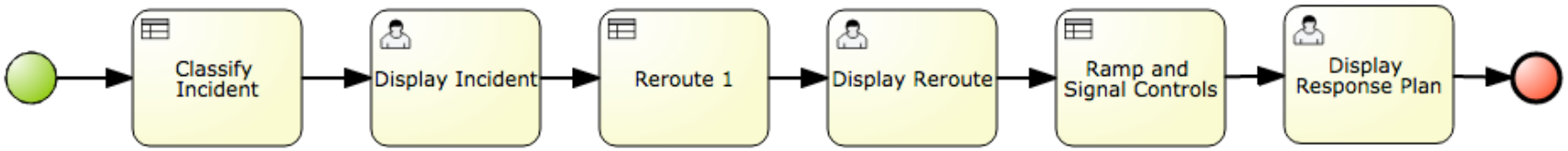


Response plan generated from rules



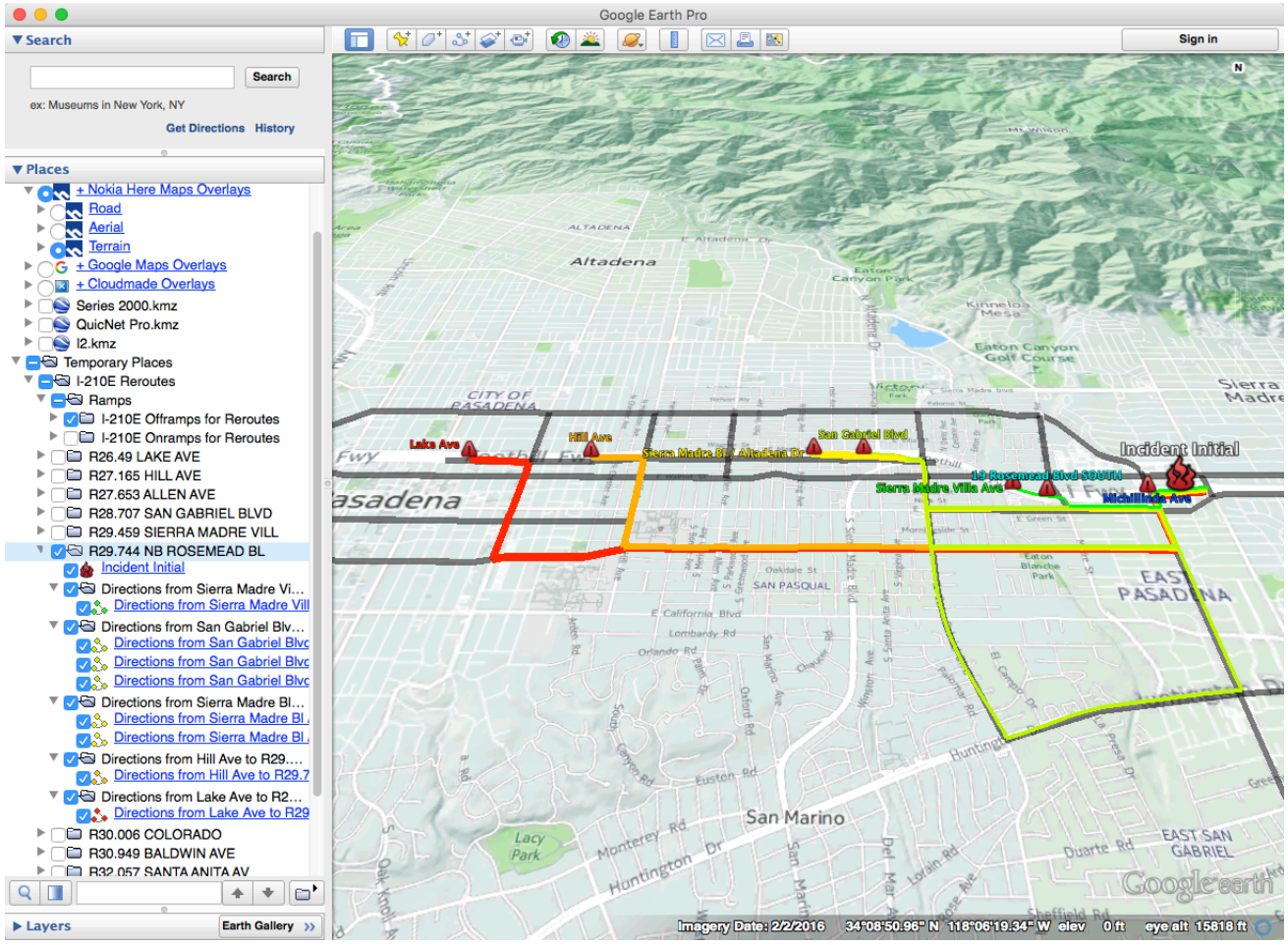
Rules Definitions in Progress

- **Incident classification**
  - TIM Severity *(based on duration)*
  - Corridor Impact *(based on duration, weather, time of day…)*
- **Reroute around extended incident**
  - *Based on incident initial & end postmiles and predefined routes*
- **Arterial signal timing for reroute**
  - *Based on severity, time of day, and reroute's arterial*
- **Ramp metering for reroute return onramp**
  - *Based on severity and reroute's return onramp*
- **Notification recipients**
  - *Based on incident initial & end postmiles*

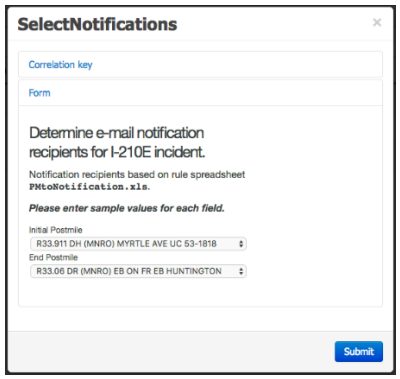


Caltrans Metro Foothill Transit

Determine possible reroutes



Determine e-mail recipients for I-210 incident



Work | Details | Process Context | Assignments

Entered incident postmiles:

Initial Postmile: R33.911 DH (MNRO) MYRTLE AVE UC 53-1818

End Postmile: R33.06 DR (MNRO) EB ON FR EB HUNTINGTON

Notification recipients:

(based on rules in PMtoNotification.xls spreadsheet)

Items
lhui@ArcadiaCA.gov
samson.teshome@dot.ca.gov
boconnor@ci.monrovia.ca.us
congestionreduction@metro.net
general_notification@berkeley.edu

Home | Layout | Tables | Charts | SmartArt | Formulas | Data | Review

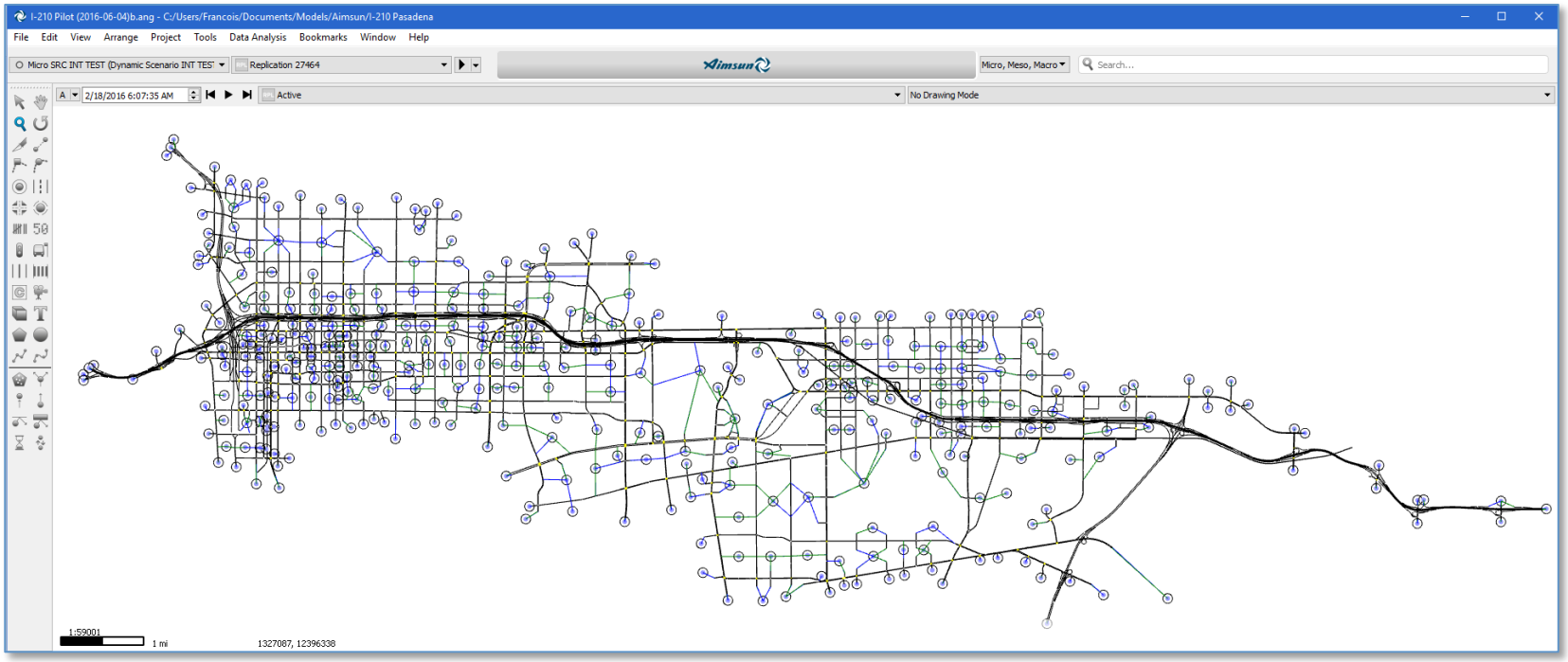
H42

	D	E	F
6	**City/Stakeholder PMs**		
7	CONDITION	CONDITION	ACTION
10	**Min PM - Area of Interest**	**Max PM - Area of Interest**	**City/Stakeholder**
11	20.00	38.00	CaltransD7
12	21.00	32.00	Pasadena
13	28.00	34.00	Arcadia
14	31.00	36.00	Monrovia
15	34.00	38.00	Duarte
16			
17	**Recipients by City/Stakeholder**		
18	CONDITION	CONDITION	ACTION
21		**City**	**Contact**
22	x	Arcadia	lhui@ArcadiaCA.gov
23	x	CaltransD7	samson.teshome@dot.ca.gov
24	x	Duarte	publicworks@accessduarte.com
25	x	Monrovia	boconnor@ci.monrovia.ca.us
26	x	Pasadena	trafficmanager@cityofpasadena.net
27	x	Pasadena	trafficengineer@cityofpasadena.net
28	x	Pasadena	nbaculinao@cityofpasadena.net
29	x		congestionreduction@metro.net
30	x		general_notification@berkeley.edu

Simulation Modeling

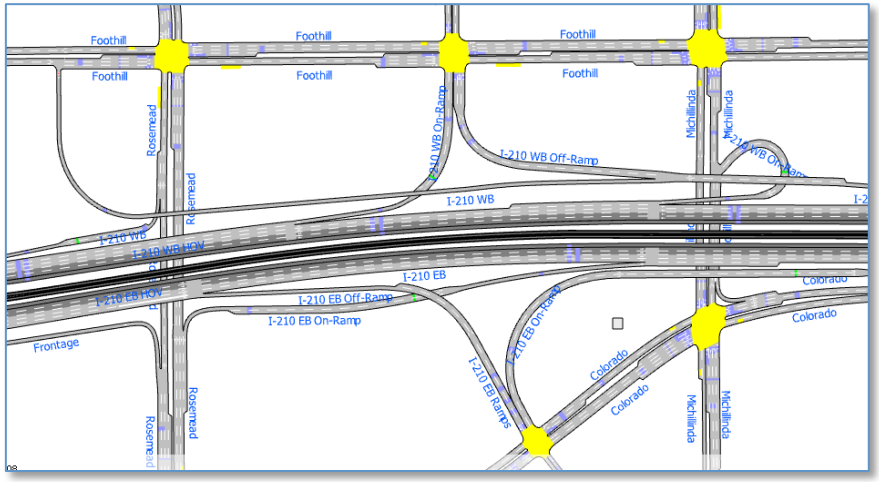
Aimsun Model

- **Coding of geometrical and basic control elements completed**



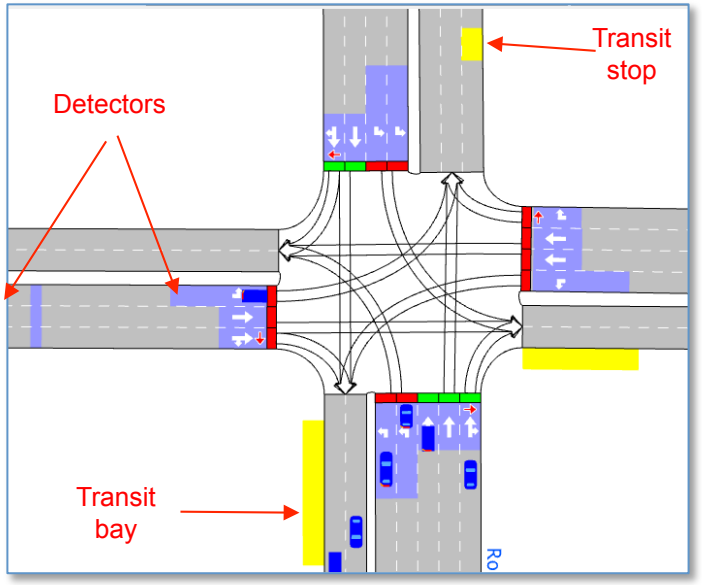
Aimsun Model

- **Freeway elements**
  - Roadways
    - Mainline lanes
    - HOV lanes
    - On-ramps and off-ramps
  - Speed limits
    - 65 mph on freeway
    - 50 mph on ramps
  - Truck restrictions
    - Two leftmost lanes
  - Traffic detectors
    - Mainline, ramps, HOV lanes
  - Ramp meters
    - Time-of-day operations for now
  - Changeable message signs
    - Current and future



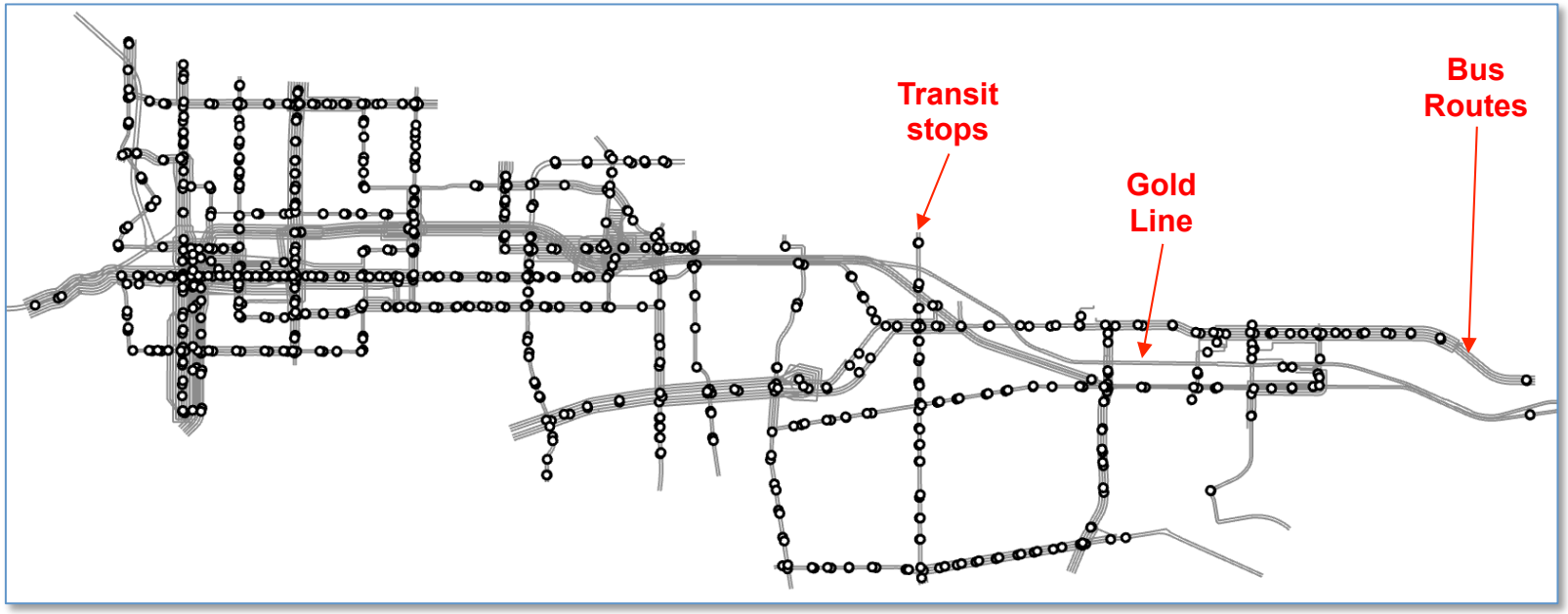
Aimsun Model

- **Intersections elements**
  - Lane markings
  - Approach speed limits
    - 25 to 45 mph, based on posted signs and local regulations
  - Movements within intersection
    - Destination lanes
    - Yielding movements
    - Right turn on red
  - Traffic detectors
    - Location
    - Size
    - Signal control phase associations
  - Traffic signal operations
    - Fixed time and actuated-coordinated operations
    - Timing plan schedule (over 24 hours, weekdays and weekend)
  - Stop-controlled intersections



Aimsun Model

- **Transit services modeled**
  - Metro Gold Line
  - Bus routes operated by Metro Bus *(18)*, Foothill Transit *(5)*, LA DOT *(1)*, Pasadena Transit *(9)* and Duarte Transit *(2)*



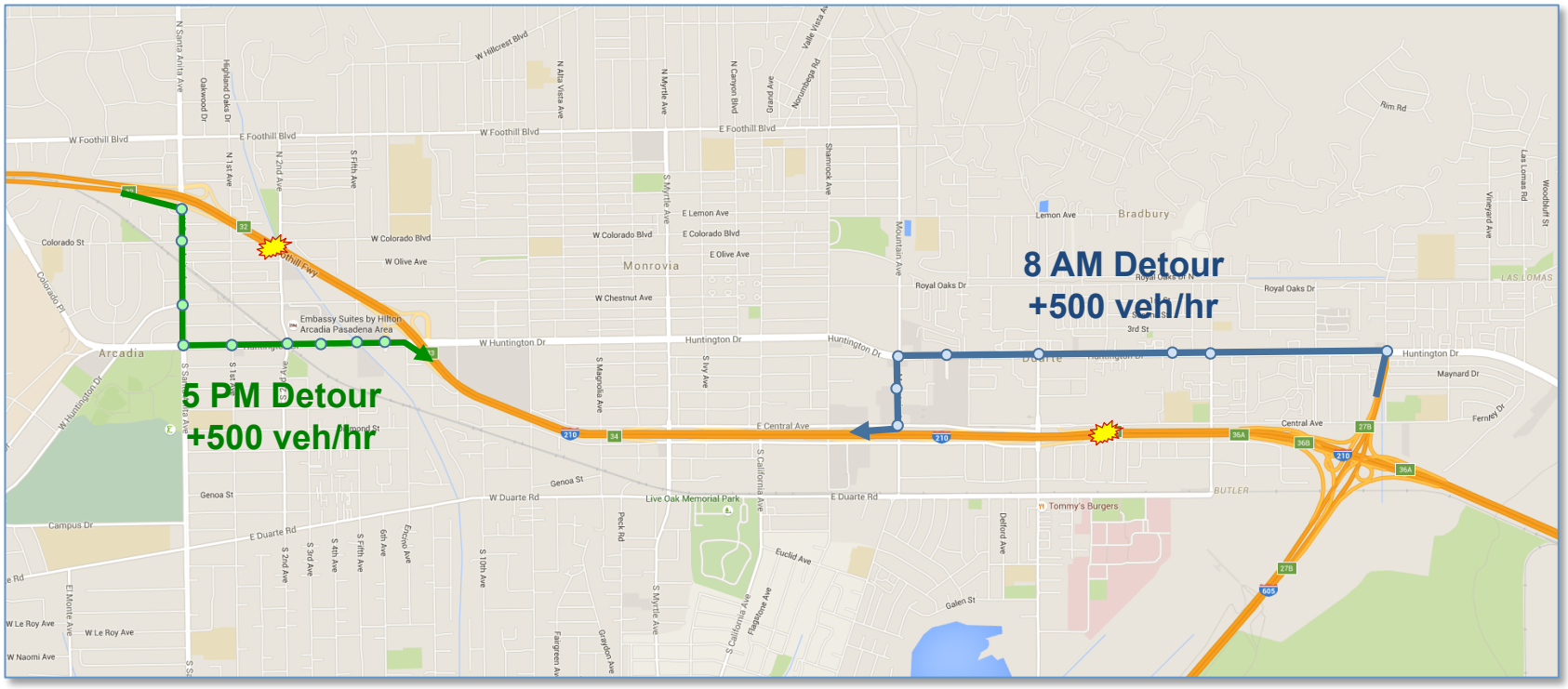
Aimsun Model

- **Demand modeling**
  - Completed the mapping of modeled traffic origin/destination nodes to the regional Traffic Analysis Zones (TAZ)
  - Currently inputting available freeway and arterial traffic counts into Aimsun
    - Data to be used as calibration elements
  - Approached SCAG to obtain trip data from the 2008 Regional Travel Demand Model
    - Request cannot be fulfilled → Agency in process of developing next long-range plan
  - Obtained Caltrans 2008 Regional Travel Demand Model
    - TransCAD Model based on SCAG's regional model
    - Raj Porandla, from Caltrans Headquarters, is assisting in running the model and extracting desired origin-destination flows and routing patterns
  - Extracted origin-destination demand data from Pasadena's 2012 VISUM Dynamic Traffic Assignment model
    - Passenger cars
    - HOV vehicles

Synchro Analysis

Reroutes Analyzed

- **Considering 2 short detours during peak travel periods**



Foothill Detour

Normal Situation (Optimized)

												Intersection				Movement			
Arterial	Intersection	Dir	Mov	Vol.		Cycle	Offset	Green	Change	%		ICU	Max V/C	Delay	LOS	Capacity	V/C	Delay	LOS
Huntington	Mount Olive	NB	Left	749	120	120	0	37.0	0.0	31%		90.8%	1.02	61.4	E	764	0.98	81.1	F
Huntington	Highland	WB	Through	1625	90	120	61	81.0	0.0	68%		80.0%	0.91	25.9	C	2,500	0.65	10.7	B
Huntington	Pops	WB	Through	1569	90	120	36	72.0	0.0	60%		60.4%	0.77	16.7	B	2,038	0.77	12.6	B
Huntington	Buena Vista	WB	Through	1215	90	120	109	60.0	0.0	50%		67.6%	0.81	24.7	C	2,025	0.60	6.3	A
Huntington	Mountain Vista Pla	WB	Through	1425	75	120	34	82.0	0.0	68%		54.7%	0.51	3.9	A	2,794	0.51	1.0	A
Huntington	Mountain	WB	Left	320	90	120	25	33.0	0.0	28%		73.9%	0.88	34.4	C	376	0.85	54.3	D
Mountain	Best Buy	SB	Through	554	60	120	76	81.0	0.0	68%		37.8%	0.28	2.5	A	2,916	0.19	0.3	A
Mountain	Central	SB	Right	574	60	90	11	34.0	0.0	38%		58.9%	0.77	20.4	C	1,305	0.44	20.3	C
Mountain	I-210 WB On Ramp	WB		325								21.3%							

3.1 min

Normal Situation (Optimized) + 500 veh/hr

												Intersection				Movement			
Arterial	Intersection	Dir	Mov	Vol.		Cycle	Offset	Green	Change	%		ICU	Max V/C	Delay	LOS	Capacity	V/C	Delay	LOS
Huntington	Mount Olive	NB	Left	1249	120	120	0	37.0	0.0	31%		104.6%	1.58	129.6	F	801	1.56	292.0	F
Huntington	Highland	WB	Through	2125	90	120	61	81.0	0.0	68%		93.8%	0.91	30.1	C	2,530	0.84	21.7	C
Huntington	Pops	WB	Through	2069	90	120	36	72.0	0.0	60%		74.2%	1.01	35.1	D	2,049	1.01	36.9	D
Huntington	Buena Vista	WB	Through	1715	90	120	109	60.0	0.0	50%		81.5%	0.84	22.3	C	2,042	0.84	8.7	A
Huntington	Mountain Vista Pla	WB	Through	1925	75	120	34	82.0	0.0	68%		68.6%	0.69	6.7	A	2,790	0.69	3.8	A
Huntington	Mountain	WB	Left	820	90	120	25	33.0	0.0	28%		93.4%	1.18	55.5	E	695	1.18	116.8	F
Mountain	Best Buy	SB	Through	1054	60	120	76	81.0	0.0	68%		46.1%	0.35	2.2	A	3,011	0.35	0.4	A
Mountain	Central	SB	Right	1074	60	90	11	34.0	0.0	38%		75.0%	0.82	24.3	C	1,207	0.89	28.7	C
Mountain	I-210 WB On Ramp	WB		825								49.0%							

8.5 min

Normal Situation (Optimized) + 500 veh/hr + Optimized

												Intersection				Movement			
Arterial	Intersection	Dir	Mov	Vol.		Cycle	Offset	Green	Change	%		ICU	Max V/C	Delay	LOS	Capacity	V/C	Delay	LOS
Huntington	Mount Olive	NB	Left	1249	150	120	0	37.0	0.0	31%		104.6%	1.31	116.7	F	953	1.31	185.0	F
Huntington	Highland	WB	Through	2125	110	120	64	81.0	0.0	68%		93.8%	0.91	29.3	C	2,530	0.84	20.9	C
Huntington	Pops	WB	Through	2069	130	120	60	72.0	0.0	60%		74.2%	1.01	35.4	D	2,049	1.01	37.1	D
Huntington	Buena Vista	WB	Through	1715	110	120	104	69.0	9.0	58%		81.5%	0.89	21.1	C	1,927	0.89	6.1	A
Huntington	Mountain Vista Pla	WB	Through	1925	90	120	21	82.0	0.0	68%		68.6%	0.69	5.7	A	2,790	0.69	3.3	A
Huntington	Mountain	WB	Left	820	150	120	32	47.0	14.0	39%		93.4%	1.11	50.0	D	739	1.11	89.3	F
Mountain	Best Buy	SB	Through	1054	60	120	107	83.0	2.0	69%		46.1%	0.35	1.9	A	3,011	0.35	0.2	A
Mountain	Central	SB	Right	1074	60	90	27	45.0	11.0	50%		75.0%	0.84	23.2	C	1,513	0.71	20.8	C
Mountain	I-210 WB On Ramp	WB		825								49.0%							

6.0 min

Normal Situation (Optimized) + 500 veh/hr + Optimized + Manual Tweaks

												Intersection				Movement			
Arterial	Intersection	Dir	Mov	Vol.		Cycle	Offset	Green	Change	%		ICU	Max V/C	Delay	LOS	Capacity	V/C	Delay	LOS
Huntington	Mount Olive	NB	Left	1249	150	150	0	61.0	24.0	41%		104.6%	1.19	102.0	F	1,105	1.13	121.4	F
Huntington	Highland	WB	Through	2125	110	150	103	110.0	29.0	73%		93.8%	0.96	34.2	C	2,560	0.83	18.9	B
Huntington	Pops	WB	Through	2069	130	150	90	102.0	30.0	68%		74.2%	0.91	23.6	D	2,274	0.91	20.8	C
Huntington	Buena Vista	WB	Through	1715	110	150	134	90.0	30.0	60%		81.5%	0.90	27.1	C	2,171	0.79	6.0	A
Huntington	Mountain Vista Pla	WB	Through	1925	90	150	57	112.0	30.0	75%		68.6%	0.68	4.7	A	2,831	0.68	2.0	A
Huntington	Mountain	WB	Left	820	150	150	97	70.0	37.0	47%		93.4%	1.14	56.7	D	781	1.05	73.9	E
Mountain	Best Buy	SB	Through	1054	60	75	24	80.0	-1.0	53%		46.1%	0.36	2.3	A	2,928	0.36	2.3	A
Mountain	Central	SB	Right	1074	60	75	19	76.0	42.0	51%		75.0%	0.85	19.2	B	1,451	0.74	13.5	B
Mountain	I-210 WB On Ramp	WB		825								49.0%							

4.3 min

- **Timing changes**
  - 24 to 37 s green increase
  - 150-s coordination cycle
- **Impacts**
  - Additional traffic increases travel time from 3.1 to 8.5 min
  - Signal changes reduce travel time along detour from 8.5 to 4.3 min
  - Route capacity increased from 376 veh/hr to 781 veh/hr (left-turn limit at Huntington/Mountain)
- **Notes**
  - Busiest intersection constrain what can be done
  - Evaluation assuming peak-hour flow is sustained
  - Some flows were estimated
  - Likely conservative estimates, as Synchro has difficulty estimating delays in oversaturation
  - Network effects not fully considered

Santa Anita Detour

Normal Situation (Optimized)

												Intersection				Movement	
Arterial	Intersection	Dir	Movement	Volume		Cycle	Offset	Green	Change	%		ICU	Max	Delay	LOS	Delay	LOS
Santa Anita	I-210 EB Ramps	EB	Right	251	60	80	51	17.0	1.0	21%		59.5%	0.74	16.3	B	10.9	B
Santa Anita	Colorado	SB	Through	830	65	120	58	72.0	29.0	60%		71.3%	1.29	29.8	C	29.2	C
Santa Anita	Santa Clara	SB	Through	667	100	120	58	35.0	-3.0	29%		71.5%	1.05	66.5	E	63.1	E
Santa Anita	Huntington	SB	Left	127	90	120	35	13.5	-2.5	11%		74.3%	0.85	29.4	C	86.7	F
Huntington	First	EB	Through	1190	60	120	71	84.0	7.0	70%		54.9%	0.69	3.5	A	0.9	A
Huntington	Second	EB	Through	1210	70	120	103	74.0	9.0	62%		65.7%	1.04	25.5	C	5.5	A
Huntington	Gateway	EB	Through	1558	80	120	15	88.0	3.0	73%		83.2%	0.96	22.5	C	20.5	C
Huntington	Fifth	EB	Through	1450	120	120	35	91.5	16.5	76%		84.9%	0.93	17.8	B	5.0	A
Huntington	I-210 EB Off Ramp	EB	Through	1882	80	70	38	26.8	5.8	38%		61.0%	0.71	16.6	B	18.9	B
Huntington	I-210 EB On-Ramp	EB	Right									55.2%					

4.01 min

500 veh/hr Additional Flow / Offset Optimization

												Intersection				Movement	
Arterial	Intersection	Dir	Movement	Volume		Cycle	Offset	Green	Change	%		ICU	Max	Delay	LOS	Delay	LOS
Santa Anita	I-210 EB Ramps	EB	Right	251	75	90	5	16.0	-1.0	18%		64.7%	1.09	33.6	C	79.4	E
Santa Anita	Colorado	SB	Through	830	65	120	118	43.0	-29.0	36%		80.0%	0.78	28.4	C	21.2	C
Santa Anita	Santa Clara	SB	Through	667	130	120	69	38.0	3.0	32%		78.9%	5.04	374.4	F	52.1	D
Santa Anita	Huntington	SB	Left	127	90	120	24	16.0	2.5	13%		83.8%	0.91	30.0	D	33.8	C
Huntington	First	EB	Through	1190	80	120	36	77.0	-7.0	64%		62.0%	0.62	5.4	A	4.0	A
Huntington	Second	EB	Through	1210	90	120	11	65.0	-9.0	54%		82.3%	1.00	18.5	C	16.5	B
Huntington	Gateway	EB	Through	1558	90	120	15	85.0	-3.0	71%		97.0%	1.65	23.6	C	9.5	A
Huntington	Fifth	EB	Through	1450	120	120	16	75.0	-16.5	63%		98.7%	1.76	27.8	C	10.5	B
Huntington	I-210 EB Off Ramp	EB	Through	1882	90	70	38	21.0	-5.8	30%		70.7%	0.92	23.6	C	28.6	C
Huntington	I-210 EB On-Ramp	EB	Right									66.5%					

4.26 min

500 veh/hr Additional Flow / 10 s Additional Green / 130 Cycle / Offset Optimization

												Intersection				Movement	
Arterial	Intersection	Dir	Movement	Volume		Cycle	Offset	Green	Change	%		ICU	Max	Delay	LOS	Delay	LOS
Santa Anita	I-210 EB Ramps	EB	Right	251	75	90	0	26.0	10.0	29%		64.7%	0.96	28.8	C	49.1	D
Santa Anita	Colorado	SB	Through	830	65	130	66	53.0	10.0	41%		80.0%	0.77	23.7	C	23.3	C
Santa Anita	Santa Clara	SB	Through	667	130	130	129	48.0	10.0	37%		78.9%	10.39	67.6	E	15.5	B
Santa Anita	Huntington	SB	Left	127	90	130	58	26.0	10.0	20%		83.8%	0.92	35.9	D	42.1	D
Huntington	First	EB	Through	1190	80	130	85	87.0	10.0	67%		62.0%	0.72	5.2	A	2.2	A
Huntington	Second	EB	Through	1210	90	130	108	75.0	10.0	58%		82.3%	1.07	15.7	B	4.2	A
Huntington	Gateway	EB	Through	1558	90	130	113	95.0	10.0	73%		97.0%	1.76	26.7	C	10.4	B
Huntington	Fifth	EB	Through	1450	120	130	113	85.0	10.0	65%		98.7%	1.88	29.7	C	11.1	B
Huntington	I-210 EB Off Ramp	EB	Through	1882	90	70	0	31.0	10.0	44%		70.7%	0.85	20.5	C	23.0	C
Huntington	I-210 EB On-Ramp	EB	Right									66.5%					

3.02 min

- **Potential benefits from timing adjustment**
  - Adding 10 s green reduce travel time along detour from 4.3 to 3.0 min
- **Notes**
  - Busiest intersection constrains what can be done
  - Evaluations assuming peak-hour flow is sustained
  - Synchro has difficulty calculating delays where oversaturation occurs
  - Network effects not considered

AMS Effort

AMS Effort – Next Steps

- **Calibration of Aimsun model**
  - Freeway flow calibration to occur first
  - Arterial calibration to occur in stage following freeway calibration
    - Tighter calibration for key arterials close to freeway and key reroutes
    - Looser calibration for non-reroute arterials away from freeway and secondary streets
  - Calibration for each hour of the day
    - AM Peak, Midday, PM peak
    - Individual weekdays

Goals:

- Preliminary model that can be used for *concept assessment* available in 3 months
- 80% calibrated model in 6 months, if no major problems are encountered

AMS Effort – Next Steps

- **Development and evaluation of signal timing response plans**
  - Identify response plan needs for individual intersections based on
    - Identified detours
    - Ability to use existing timing plans
    - Ability to store additional timing plans within each signal controller
  - Design coordination plans for individual reroutes based on
    - Synchro optimization
    - Local control principles/constraints
  - Use Aimsun to simulate efficiency of proposed response timings

Goals:

- Preliminary evaluation of proposed response strategy for several key detours over next 3-6 months
- Use simulation results to develop general guidelines for the design of signal timing plans for incident response

Action Items and Next Meeting Time

Thank You