Connected Corridors
Face-to-Face Meeting

Tuesday, Sept 13th, 2016 – 1:30 – 3:30 pm
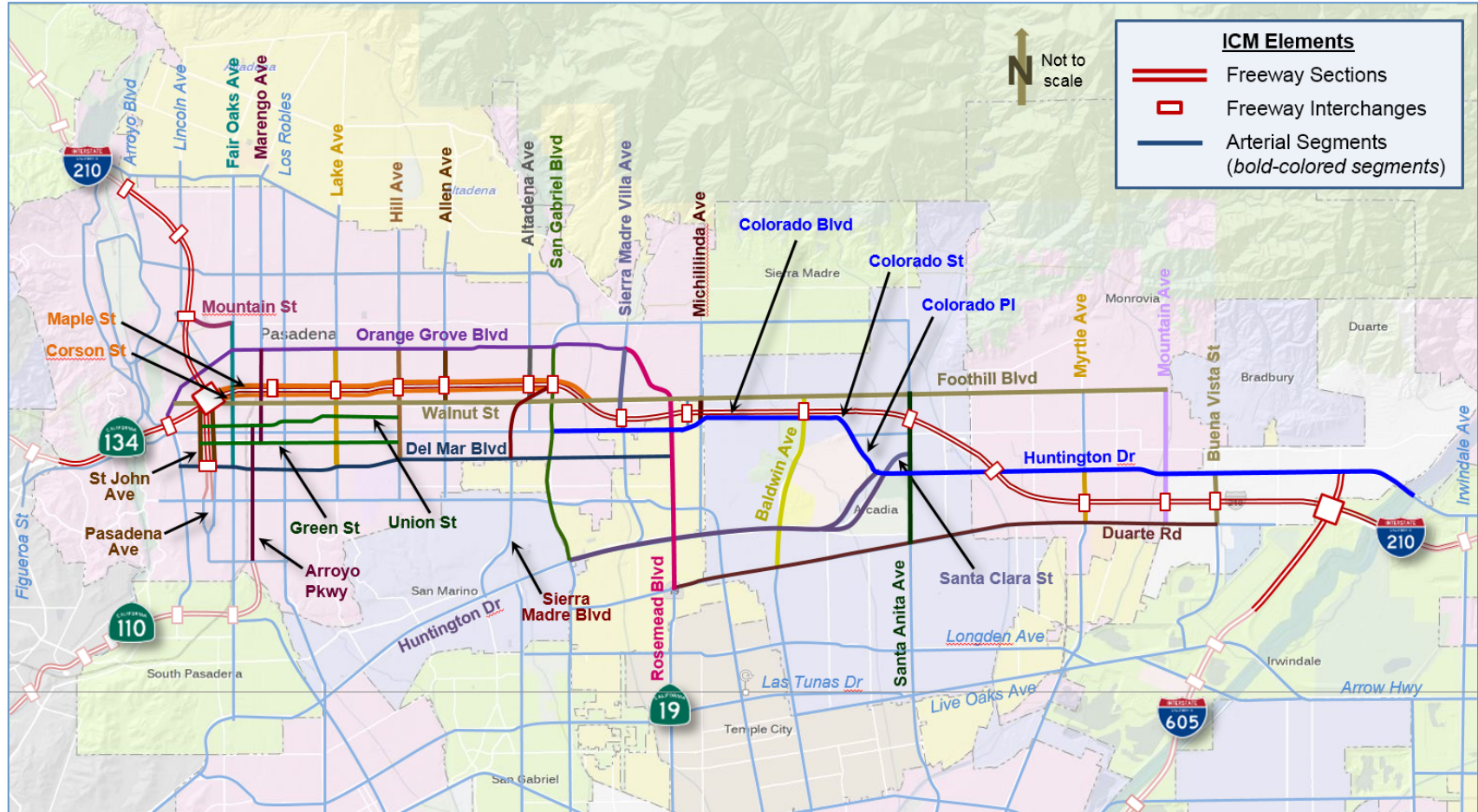Caltrans D7 HQ

Sept 13th, 2016

Agenda

- **Introductions**

- **Schedule Update**

- **Outreach**

- **Presentation by Lyft**

- **High Level Design**

- **Lane Closure System Demo**

- **Infrastructure and Partner projects**

- **(AMS) – Modeling and Response Plans**
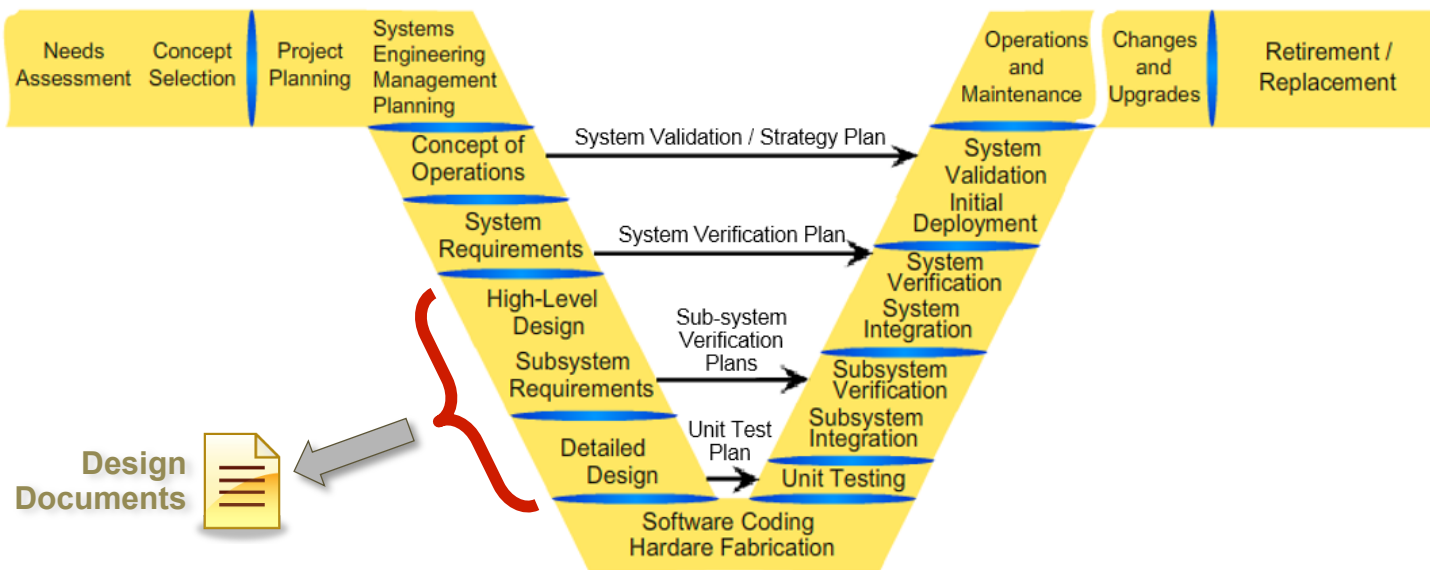
- **Action Items and Closing**

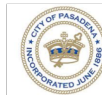# Our Corridor: The I-210

Systems Engineering Next Steps

☐ **Systems Requirements – What should the ICM system do**

☐ **Design Documents – How will the requirements be met**

Next Face to Face is Special – AMS Review

- **FHWA is paying for a review of CC Analysis, Modeling and Simulation (AMS)**

- **Review is by**
  - Vassili Alexiadis from Cambridge Systematics – A true expert in this area
  - Alex Skabardonis from Berkeley may attend – Helped write the highway manual
  - Several personnel from FHWA will also attend

- **Agenda for Tuesday Oct 25th**
  - 9:00-12:00 – In depth review of our modelling and analysis – Traffic engineers interested in modeling are encouraged to attend
  - 12:00-1:30 – Lunch Provided. Review of the lessons learned from other ICM efforts in the US
  - 1:30-3:30 – Our normal Face-to-Face
  - Still discussing where it will be held (here or in the Corridor)
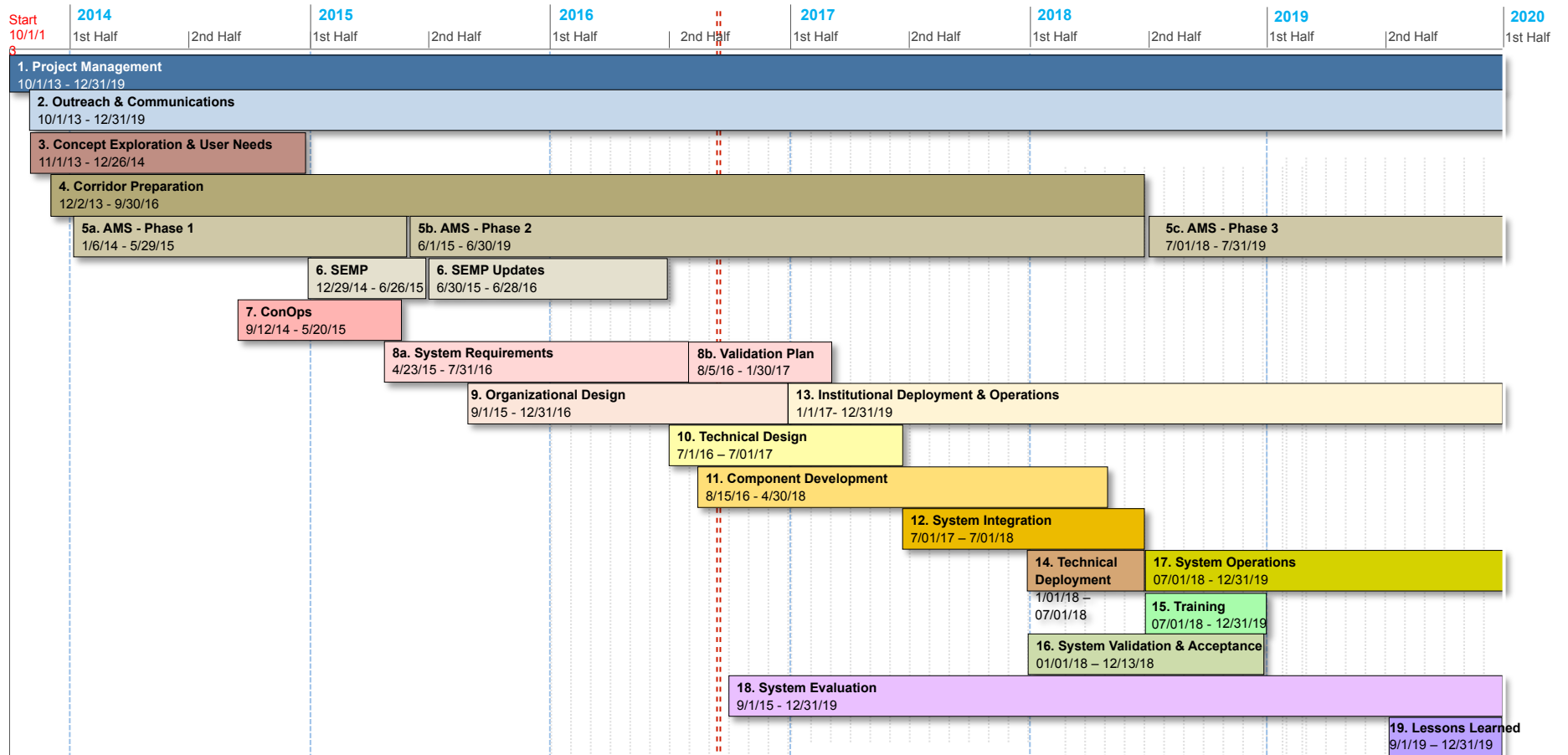 - Who do we see attending (there maybe others not normally in this meeting who would like to attend)

6 Schedule Update

Schedule

	2014		2015		2016		2017		2018		2019		2020
Start 10/1/13	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	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 - 7/31/16

8b. Validation Plan
8/5/16 - 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

Outreach and Communications

Summer Connected Newsletter

Connected
Summer 2016
A Quarterly Newsletter for Connected Corridors Stakeholders

Update

Lots of changes have happened over the summer for the Connected Corridors Pilot. Joan Sollenberger at Caltrans Headquarters and Sam Esquenazi at Caltrans District 7 both retired. Nick Compin has been promoted to Chief – Office of Strategic Development and Allen Chen has been assigned to fill Sam's role related to CC. A very special thanks to Joan and Sam for their decades of service to the state of California and specifically for spearheading and leading the Connected Corridors Pilot since its inception. Readers can learn more about Allen Chen's vision for the CC Pilot on page 6. Brian Simi has also joined the team as the Acting System Management Principal.

The requirements phase of the Pilot is nearing completion, and work has proceeded into the high-level design and response planning phases. More information on the progress made is on pages 2-5.

Caltrans detector health is improving, and the team is starting to review city sensor data. The I-210 corridor-wide Aimsun traffic simulation model is up and running with over 450 intersections. We will discuss this model in our next newsletter.

IT Series: CC in the Cloud

This new series will focus on how new or growing information technologies work and their relevance to the Connected Corridors program. For this first edition, Greg Merritt with PATH highlights cloud computing.

The formula for success for Connected Corridors includes the use of corridor-scale data analytics and real-time traffic simulations to support analysis and management of the corridor. It's no surprise, then, that Integrated Corridor Management requires some heavy-duty computing horsepower.

Connected Corridors has chosen a cloud computing strategy to meet these computing needs. Cloud computing is an umbrella term used to describe a wide variety of computing services, rather than any particular sort of computer equipment. Why is this distinction important?

Not long ago, individuals and organizations could only meet computing needs by purchasing, configuring, and maintaining their own computer equipment. Whether used to provide file storage, web site hosting, database services, or simulation environments, this expensive physical infrastructure had to be sized to meet peak demand to avoid service interruptions when demand exceeded capacity.

Project Charter Amendment

- Background, documents approved, meetings held, funding secured

- Primary Changes

  - Updated contacts

  - Review/approval of the System Requirements

  - Ownership/operations of the Call for Projects improvements

  - Execution of additional agreements, as needed

- Comments?

SCAG Regional Transportation Plan

FOCUS

BENEFITS OF TRANSPORTATION SYSTEMS MANAGEMENT/ TRANSPORTATION DEMAND MANAGEMENT (TSM/TDM)

Enhanced Incident Management
Reduces incident-related congestion, which is estimated to represent half of the total congestion in urban areas

Transit Automatic Vehicle Location
Enables monitoring of transit vehicles and ensures on-time performance

Advanced Ramp Metering
Alleviates congestion and reduces collisions at on-ramps and highway-to-highway interchanges

Traffic Signal Synchronization
Minimizes wait times at traffic signals and therefore reduces travel time

Improved Data Collection
Allows implementing agencies and operators to monitor system performance and optimize the impact of transportation investments

Advanced Traveler Information
Provides real-time traffic conditions and alternative routing, and therefore allows the public to make more informed travel decisions

Universal Transit Fare Cards (Smart Cards)
Reduces time required to purchase transit tickets and allows interoperability among transit providers

Case Study: Interstate 210 Pilot Project

Historically, efforts to reduce congestion have focused solely on individual networks, in which underutilized capacity in parallel highway lanes, arterial lanes and transit services were often not considered. In recent years, TSM/TDM strategies have been developed to increase efficiency through the use of technologies. The application of these technologies, such as intelligent transportation systems (ITS), and a commitment by Caltrans and its partner agencies to work together have the potential to transform the ways that corridors are currently operated.

In 2012, Caltrans, with assistance from Metro and California Partners for Advanced Transportation Technology (PATH) at UC Berkeley, developed the first Integrated Corridor Management (ICM) pilot project within the SCAG region along the Interstate 210 (I-210) corridor. The purpose of the pilot is to look at all opportunities to move people and goods in the most efficient manner possible, to ensure the greatest potential gains in operational performance. This includes

seeking ways to improve how arterials, highways, transit and parking systems work in conjunction with one another.

Strategies to be considered as part of the project include:

- Integration of highway ramp meters and arterial signal systems
- Arterial signal coordination
- Traffic re-routing due to incidents or events
- Transit signal priority on arterials and on-ramps
- Parking management (e.g., smart parking—locating available parking spaces at transit stations and private parking garages)
- Variable lane configuration systems
- Traveler communication (via changeable message signs, 511, radio, social networks, mobile app) of traffic

conditions, transit services, parking, alternate route/trip/mode options

- System coordination/communication between Caltrans and local jurisdictions

The pilot is still under development, but it has already changed the way state and local transportation agencies work together in managing transportation systems. Caltrans aims to eventually expand the application of ICM concepts to other corridors over the next ten years. In this context, the Interstate 210 Pilot is a test bed to demonstrate how an ICM project can be developed by engaging and building consensus among corridor stakeholders, to address congestion for the betterment of an entire network.

Caltrans   PATH

Lyft
and Connected Corridors

Nadir Vissanjy
Chief of Staff, Lyft Government, Education & Health Team
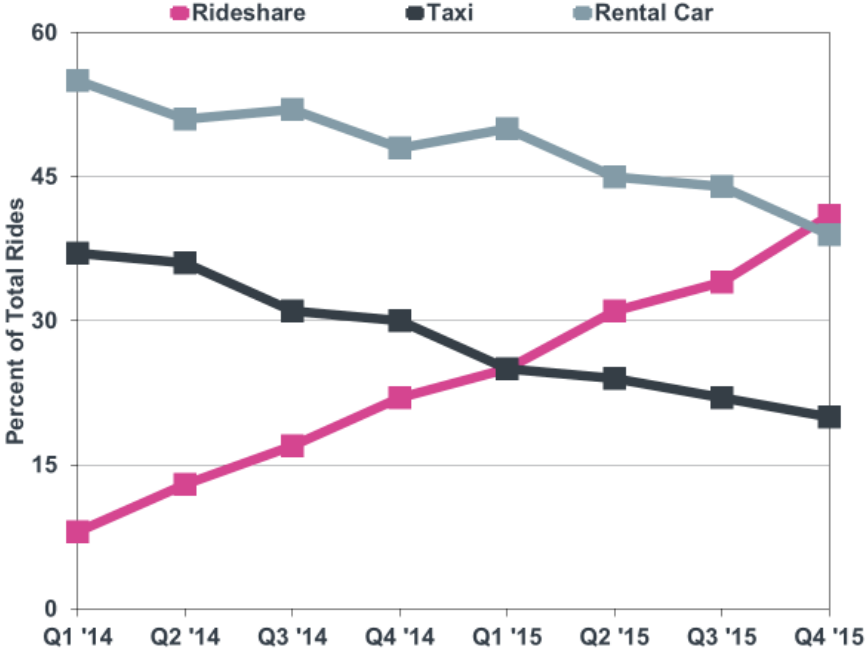Nadir@Lyft.com   916-316-5555

Our Vision

To reconnect people and communities through better transportation

Our Mission

Uniting humanity and technology to make everyday rides welcoming, affordable, and memorable

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Ridesharing's market share is growing

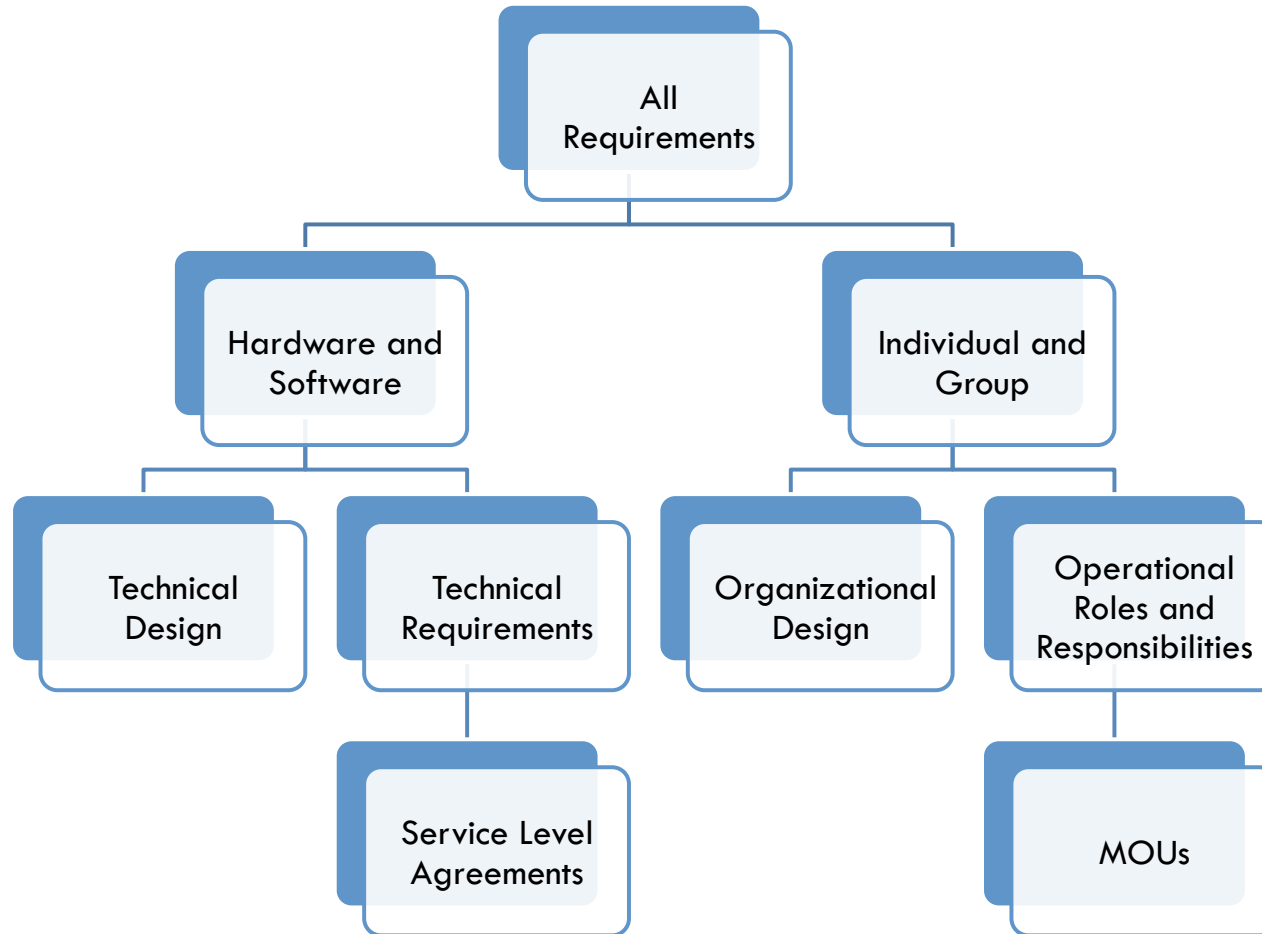Source: Certify SpendSmart Report, Q4 2015

High Level Design

High Level Design

Organizations and Personnel

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Job Descriptions and Duties/Tasks

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

I-210 Pilot System Requirements:

Job Descriptions and Duties/Tasks

September 9, 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.

- Corridor Champions
- Corridor Manager
- Corridor Technical Manager
- Corridor Data Analyst
- Traffic Engineers
- Data Analysts
- Software Engineers
- Electrical Engineers
- Database Administrators
- Stakeholders
- Maintenance Staff
- Information Technology Support
- Information Technology Security
- TMS/TCS Operators
- Transit Field Supervisors
- Public Information Officers
- First Responders
- Outreach and Communications Manager

Institutions, Organizations and Personnel

- Completed draft containing a subset of the I-210 System Requirements document
  - Job Descriptions and Duties/Tasks
  - Focused on requirements for Connected Corridors
  - Not on all duties related to Corridor Management

- We envision these being integrated into the "Inventory of Required Knowledge, Skill Sets and Abilities" being provided by the KH contract

- Lisa will begin working on system engineering design and test documents related to these institutional, organizational and personnel requirements
  - Will need to work with each of you to determine implementation and test plans
  - While there may be overlap with the KH contract we are responsible for ensuring that our requirements are met and that our system engineering process is followed so we cannot relinquish responsibility to the other contract
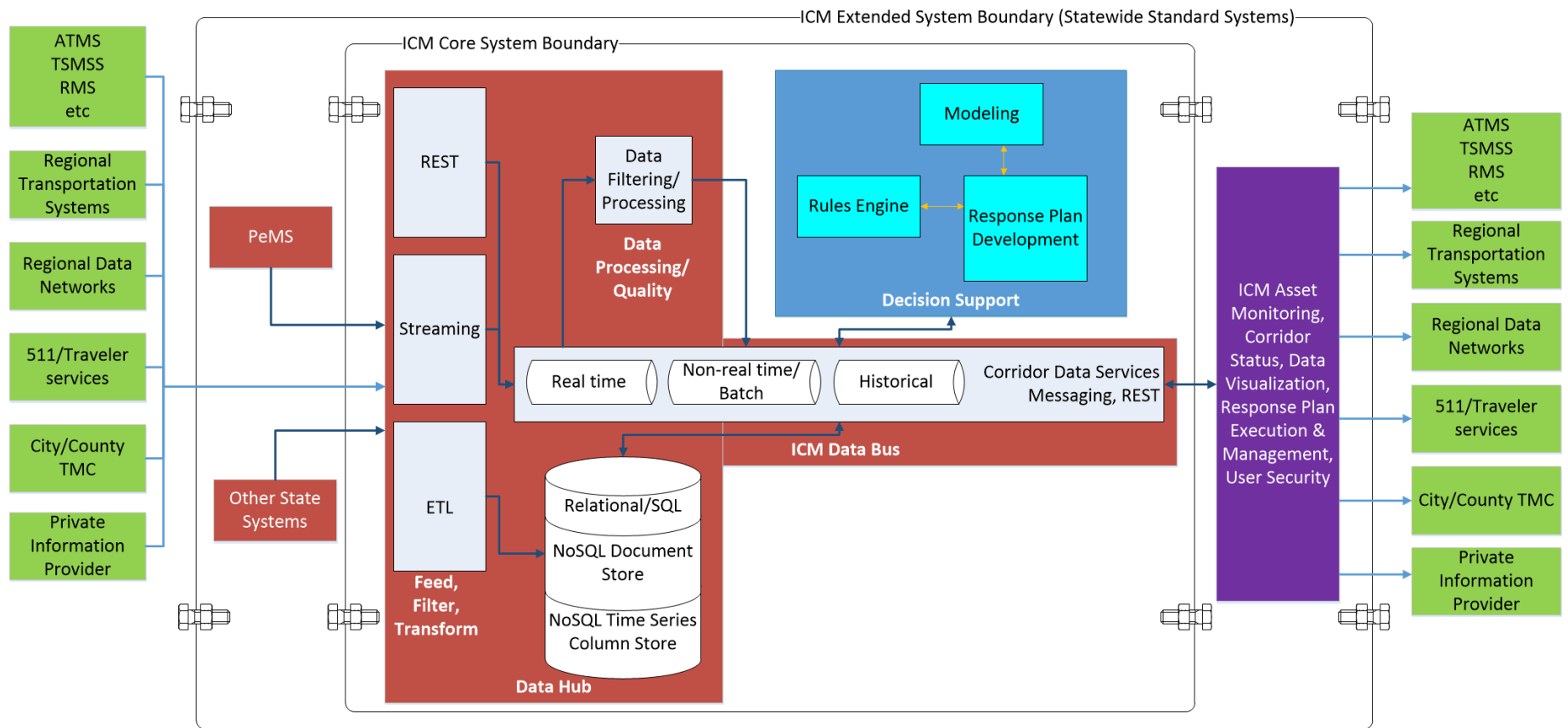
20   Technical and Data

Current Proposed ICM Architecture

Updates

- **Requirements being broken apart into technical components**
  - Detailed review
  - Sequence diagrams
  - Definition of exactly what goes in each box
  - Preparation for Proof of Concept

- **Engagement with Caltrans IT**
  - POC – Mike Nguyen
  - Meeting 9/16/16 with IT Managers to review CC Architecture
 - Short tour of Berkeley Computer Science labs to be provided

- **Engagement with possible "purple box" vendors**
  - Telegra and Kapsich
  - More to come

Updates

- Data Hub architecture effort starting

- Freeway estimation accuracy is being improved

- Meeting (as we speak) with TSS to get Aimsun model running in the cloud

- Met with companies that help manage Amazon cloud infrastructure

- Attended Cassandra conference

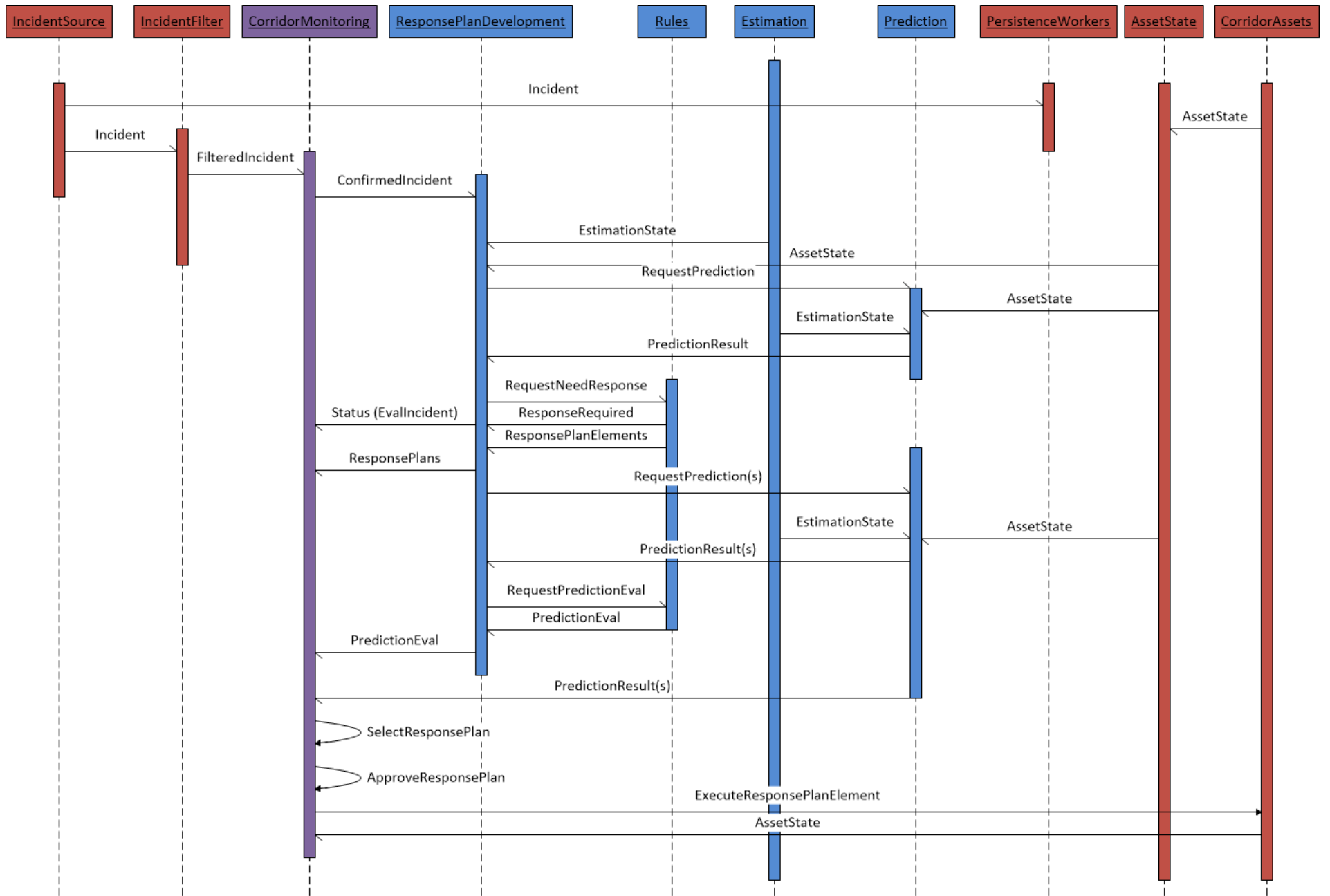- Working with Amazon to obtain free cloud training for Caltrans and others
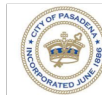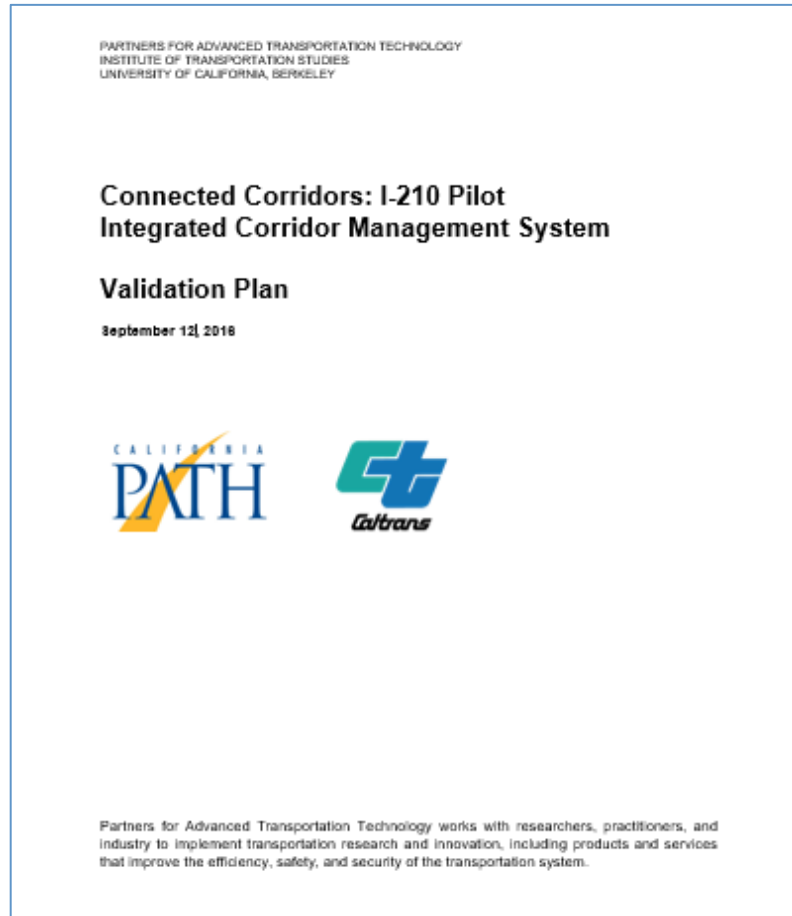
Sequence Diagram

- With the capture of an incident or event complete the following:

  - Confirm the incident

  - Determine if response plans should be developed

  - Develop those response plans

  - Evaluate all response plans (including do-nothing)

  - Recommend a response plan

  - Obtain approval for the response plan

  - Execute the response plan

System Engineering – Validation Plan

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

**Connected Corridors: I-210 Pilot
Integrated Corridor Management System**

Validation Plan

September 12, 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.

Validation Matrix

ID	User Need	Corridor Monitoring			Data Processing					System Setup and Management						
		Display Corridor Elements	Monitoring of Traffic Conditions	Monitoring of Asset Status	Execution of Historical Analysis	Generation of Traffic Estimations	Generation of Traffic Forecasts	Calculation of Performance Metrics	Generation of Performance Reports	Accessing System Environment	System Configuration	Automated Control Setup	Modification to Recommended Response Plans	System Diagnostics	Adding/Modifying/Deleting Network Elements	Modifying/Editing DSS Rules
System Monitoring																
1	Collect and Process Multimodal Data Characterizing Corridor Operational Performance		●		O	O	O	O	O							
2	Collect and Process Multimodal Corridor Travel Demand Data		●		O	O	O	O	O							
3	Monitor Asset Availability			●		O	O	O	O							
Decision Support																
4	Decision-making Assistance				O	O	O	O	O			O				O

Partner Projects

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Partner Projects

- I-210 SHOPP Project

- Metro Call for Projects

- ATMS

- TSMSS

- PEMS

- Lane Closure System

- IEN

- RIITS

- 511

- COTS POC

- CC State Wide Rollout

I-210 Pilot – SHOPP Project Update

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

Metro Call for Projects

	I-210 Connected Corridor - Pilot Project			
County		**Task Execution**		
	Communication Improvements - IEN Upgrade	*$400,000*		
Caltrans				
	New Traffic Signal	*$300,000*		
	Controller Firmware/Communication Upgrades	*$735,600*		
	Traffic Detection Improvements	*$1,753,000*		
	Communication Improvements	*$200,000*		
	Advanced Traveler Information Systems	*$912,500*		
	Environmental Stations	*$24,000*		
	Bluetooth Devices	*$110,950*		
	Total Caltrans :	**$4,036,050**		
	Total (County + Caltrans)		$4,436,050	
	Contingency (15%)	*$605,408*		
	Design	*$800,000*		
	Construction Support (Does this include inspection?)	*$600,000*		
	Total (Contingency, Design, Construction Support)	*$2,005,408*	$2,005,408	
	Percentage of total for Cont, Design, Con)	0.310627754	$6,441,458	
			Budget	$6,455,983
				$14,526

Call for Projects ITS List

- **Have list and now need design details**

- **Metro awaiting request for funding**

- **Caltrans personnel are now the lead**

- **Caltrans personnel unsure how to resource or approach**

ATMS

- **Met with Allen and Amahayes**
  - Interface not integration
  - TMC Operator is to validate corridor conditions and monitor implementation of preapproved plan

- **Identified high level requirements**

- **Provided draft list of requirements for review**

- **Next Steps:**
  - Finalize requirement
  - Initiate PID
  - Submit to SHOPP

TSMSS

- Spoke with Caltrans HQ

- Indicated that we should have a test interface in 1-3 months

- Metro/LA County requested that CC access TSMSS through IEN

PEMS

- **Decision made to use PEMS**
  - Must resolve different information received from Sandag and Iteris
  - Funding and ongoing support

- **Corridor PEMS will be expanded to the I-210**

- **Must determine level of integration of Corridor PEMS with COTS interface**
  - UI
  - Algorithms

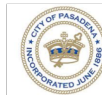# Lane Closure System

☐ **Demonstration by Mike Jenkinson**

LA County – IEN

- **Agreed to meet basic CC requirements in the following areas**
  - Signal Control and Detection
  - CMS Control and Detection (CC must determine CMS control software)
  - Travel Time – Will provide travel time between two points

- **Schedule Risk**
  - In February 2017, LA County will indicate schedule for IEN upgrades
  - If County cannot deliver functions in time for CC launch
    - CC will use IEN for reading of data
    - CC will develop interfaces/software for
      - Requesting signal plans
      - CMS signs
      - Travel Time
  - We all hope County will be able to meet CC launch schedule

RIITS – Kali Fogel

- RIITS will provide:
  - Transit information from Metro, Foothill and Pasadena Transit
  - Waze information
  - Here information

- We would work to provide Environmental data to RIITS
  - RIITS may be willing to cover the maintenance for our two environmental stations

- Video Sharing
  - RIITS has expressed interest in becoming the video sharing solution
  - However LA County also has a video sharing solution

- We agreed that RIITS would handle parking information but this was not a high priority at this time

- We agreed that more discussion was required on:
  - Incident and event information
  - Exactly how ramp metering information will work

511 – Iain Fairweather

- We will send information to 511 describing our reroutes. This will include a general message and a specific message for I-210 commuters.

- We will also send update at least once every 15 minutes.

- We will send this using RIITS APIs.

- We should be able to test this out beginning in January of 2017.

- We decided that we would not send forecast/prediction information.

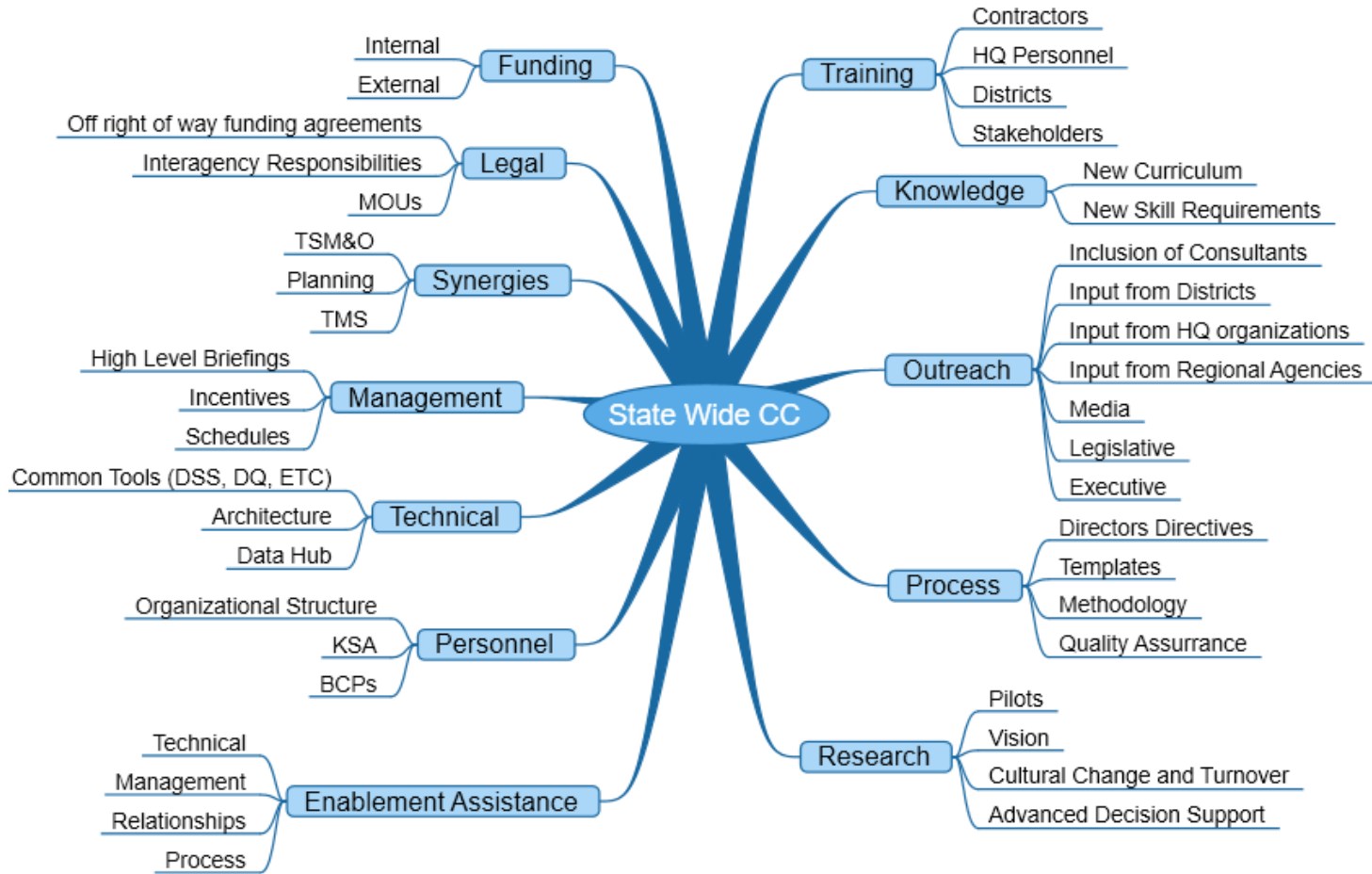- Agreed to provide call box locations for environmental sensors

COTS POC

- Have spoken with Telegra and Kapsich

- Both have an indicated an interest

- Need to speak with others

- Need to define functionality and interfaces

- Need to understand legal framework

- Need to understand scope of work for PATH as part of this

CC State Wide Roll Out

Data Quality

Freeway data quality

Weekly Average Data Quality	Eastbound I-210 PM 25 to PM 43.25						Westbound I-210 PM 25 to PM 43.25					
	Fwy-Fwy	HOV	Mainline	Off Ramp	On Ramp	Total	Fwy-Fwy	HOV	Mainline	Off Ramp	On Ramp	Total
Jul3-9	66.7%	70.2%	79.2%	70.0%	89.3%	77.4%	75.0%	60.2%	72.1%	77.0%	86.7%	72.3%
Jul10-16	64.3%	78.0%	87.1%	68.6%	92.3%	83.4%	75.0%	65.0%	76.5%	77.0%	88.3%	75.8%
Jul17-23	47.6%	81.2%	87.7%	71.4%	93.5%	84.4%	85.7%	63.2%	73.0%	74.7%	82.1%	72.9%
Jul24-30	61.9%	75.1%	80.2%	60.0%	74.4%	76.0%	100.0%	63.9%	72.0%	71.4%	73.0%	71.4%
Jul31-Aug06	33.3%	77.6%	82.2%	64.3%	82.7%	78.2%	100.0%	66.9%	75.3%	74.7%	77.6%	74.7%
Aug07-Aug13	33.3%	82.9%	87.7%	70.0%	92.3%	84.0%	100.0%	75.2%	83.2%	83.9%	91.3%	83.2%
Aug14-Aug20	33.3%	78.4%	85.8%	71.9%	87.5%	81.9%	100.0%	73.3%	80.2%	81.1%	86.7%	80.3%
Aug21-Aug27	33.3%	86.5%	90.5%	78.6%	92.9%	87.3%	100.0%	72.6%	78.3%	84.3%	84.2%	79.2%
Aug28-Sept3	33.3%	86.5%	91.1%	78.1%	92.3%	87.5%	100.0%	71.8%	78.4%	86.2%	83.2%	79.2%
Sept4-Sept10	33.3%	84.5%	90.5%	73.8%	91.1%	86.2%	100.0%	72.6%	79.6%	86.2%	85.7%	80.3%
Loops in Category	6	35	148	30	24	243	8	38	160	31	28	266

Arcadia Arterial Data Quality

Weekly Data Quality (%)	Arcadia								
	Detour Routes			Not Detour Routes			All Detectors		
	Good	Bad	No Data	Good	Bad	No Data	Good	Bad	No Data
05-Jun-2016 To 11-Jun-2016	52.07	41.94	5.99	10.34	34.48	55.17	41.62	40.07	18.31
12-Jun-2016 To 18-Jun-2016	47.00	47.00	5.99	10.34	34.48	55.17	37.82	43.87	18.31
19-Jun-2016 To 25-Jun-2016	49.05	44.96	5.99	11.33	33.50	55.17	39.60	42.09	18.31
26-Jun-2016 To 02-Jul-2016	51.38	42.63	5.99	8.97	35.86	55.17	40.76	40.93	18.31
03-Jul-2016 To 09-Jul-2016	51.91	42.10	5.99	8.97	35.86	55.17	41.15	40.54	18.31
10-Jul-2016 To 16-Jul-2016	49.84	44.17	5.99	8.97	35.86	55.17	39.60	42.09	18.31
17-Jul-2016 To 23-Jul-2016	50.53	43.48	5.99	8.97	35.86	55.17	40.12	41.57	18.31
24-Jul-2016 To 30-Jul-2016	51.32	42.69	5.99	8.97	35.86	55.17	40.71	40.98	18.31
31-Jul-2016 To 06-Aug-2016	50.99	43.02	5.99	8.97	35.86	55.17	40.46	41.23	18.31
07-Aug-2016 To 13-Aug-2016	51.42	42.59	5.99	8.97	35.86	55.17	40.78	40.91	18.31
14-Aug-2016 To 20-Aug-2016	55.92	38.08	5.99	8.97	35.86	55.17	44.16	37.53	18.31
21-Aug-2016 To 27-Aug-2016	56.98	37.03	5.99	8.97	35.86	55.17	44.95	36.74	18.31
28-Aug-2016 To 03-Sep-2016	53.59	40.42	5.99	11.92	32.91	55.17	43.15	38.54	18.31
04-Sep-2016 To 10-Sep-2016	52.47	41.54	5.99	11.23	33.60	55.17	42.14	39.55	18.31

Corridor Data

- **Freeway**
  - Good progress being made on configuration and basic hardware issues on freeway
  - Weekly hour-long meeting
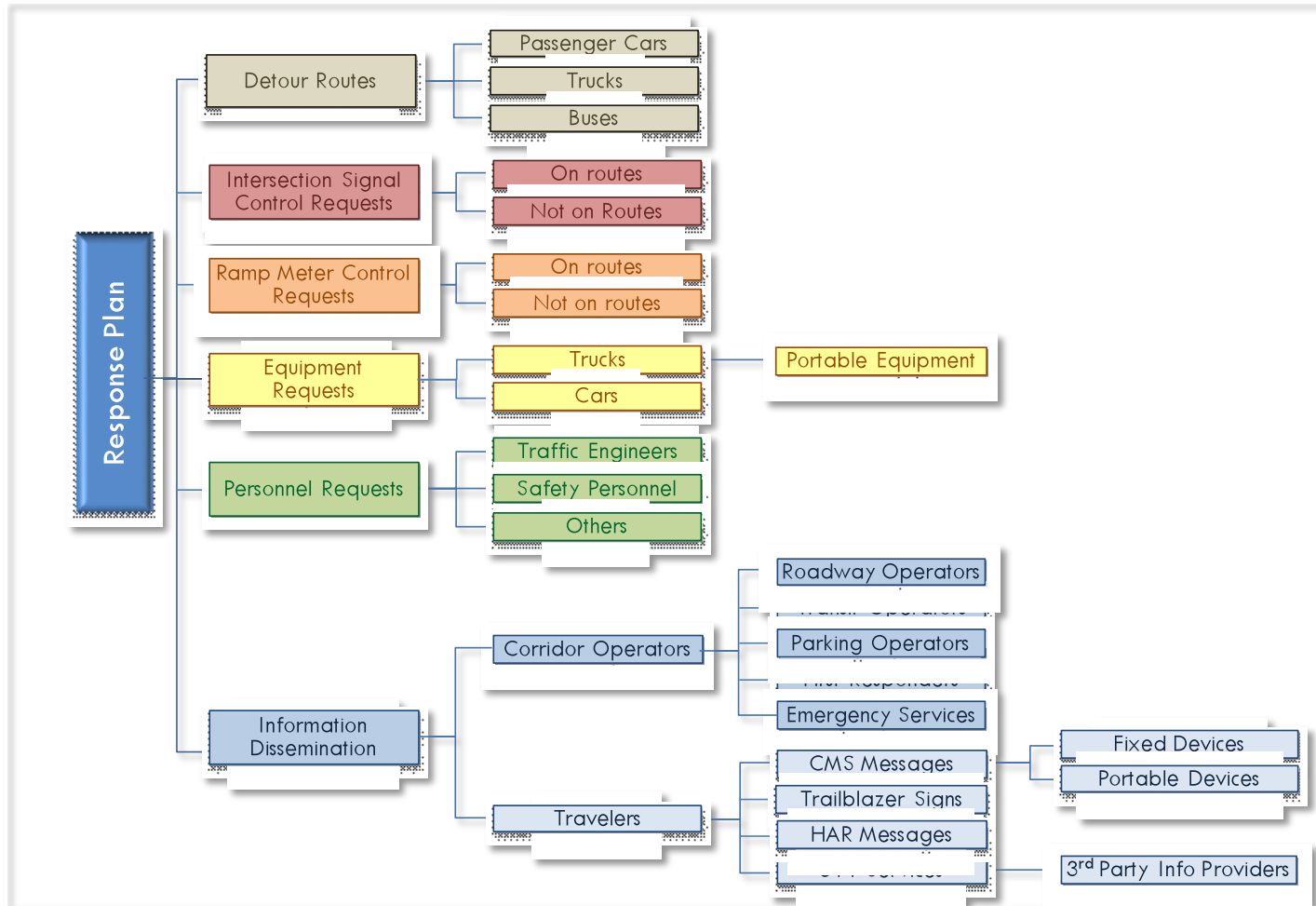 - Tracking of reasons for challenges in data quality

- **All cities and LA County have agreed to start sharing their traffic data for analysis**
  - Arcadia showing improvement
  - Dates for others?

Response Plans

# Response Plan Elements

Response Plan Meetings

□ **We held a half-day response plan and model review meeting in Arcadia on August 23rd**

  ◘ Validated alternate routes

  ◘ Discussed inputs into rerouting decisions

  ◘ Discussed inputs into timing plan decisions

  ◘ Reviewed Corridor (Micro/Meso) Model

  ◘ Ran Simulations

  ◘ Discussed thresholds for severity and determination of corridor impact

  ◘ Discussed metrics to use in making decisions

Preliminary Alternate Route "Menu"

- **300 preliminary (i.e. *possible*) alternate routes were identified between Lake and Buena Vista on the approved arterial network.**
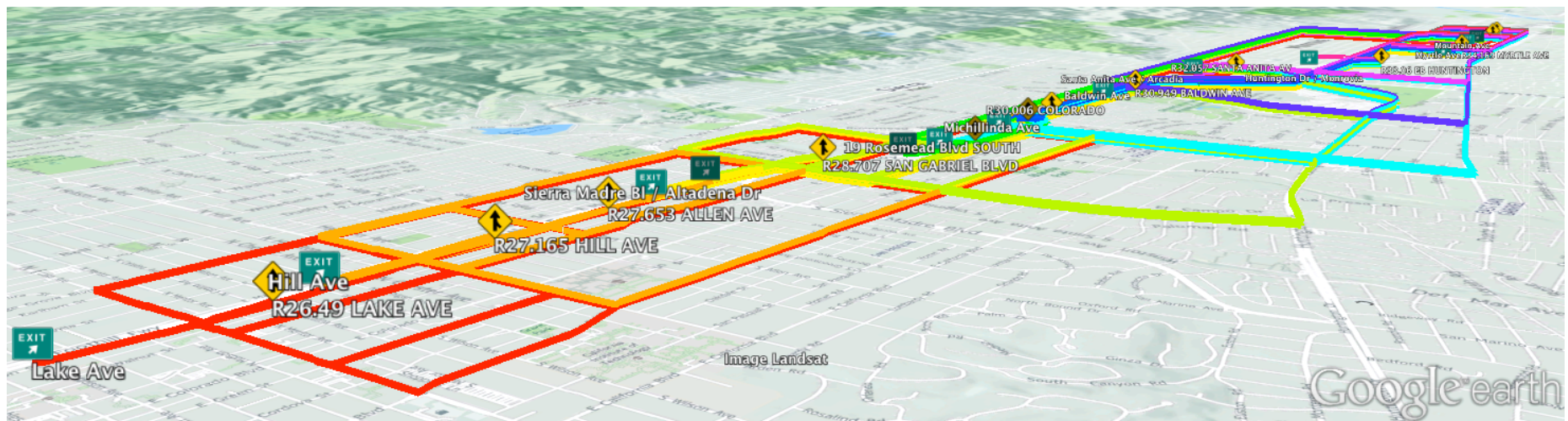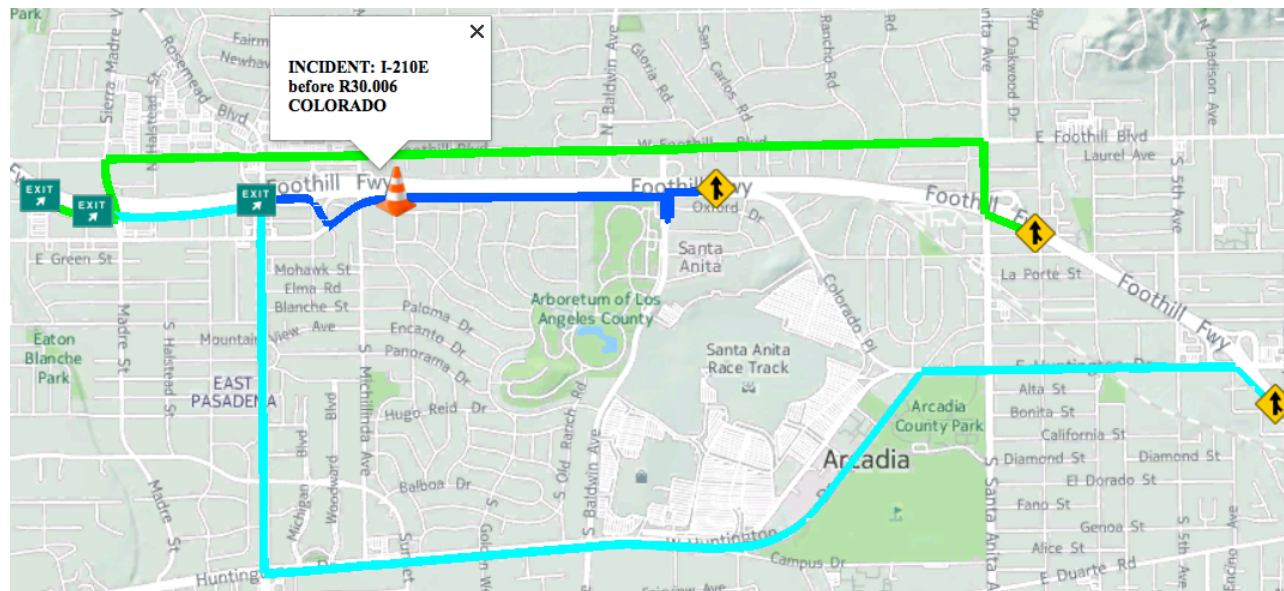

- **This set of 300 alternate routes is our "menu" of choices for alternate routes to support an incident at a given location.**

Alternate Routes for Incidents at Specific Locations

☐ **We proposed sets of specific alternate routes to support incident management for thirty locations along the I-210.**

☐ **We reviewed a number of these in detail on August 23rd.**

Response Plan Meetings

☐ **We held separate follow-up meetings on August 28-29 to review specific alternate route details and wayfinding sign installation logistics with…**

- ☐ Pasadena
- ☐ Arcadia
- ☐ Monrovia
- ☐ L.A. County

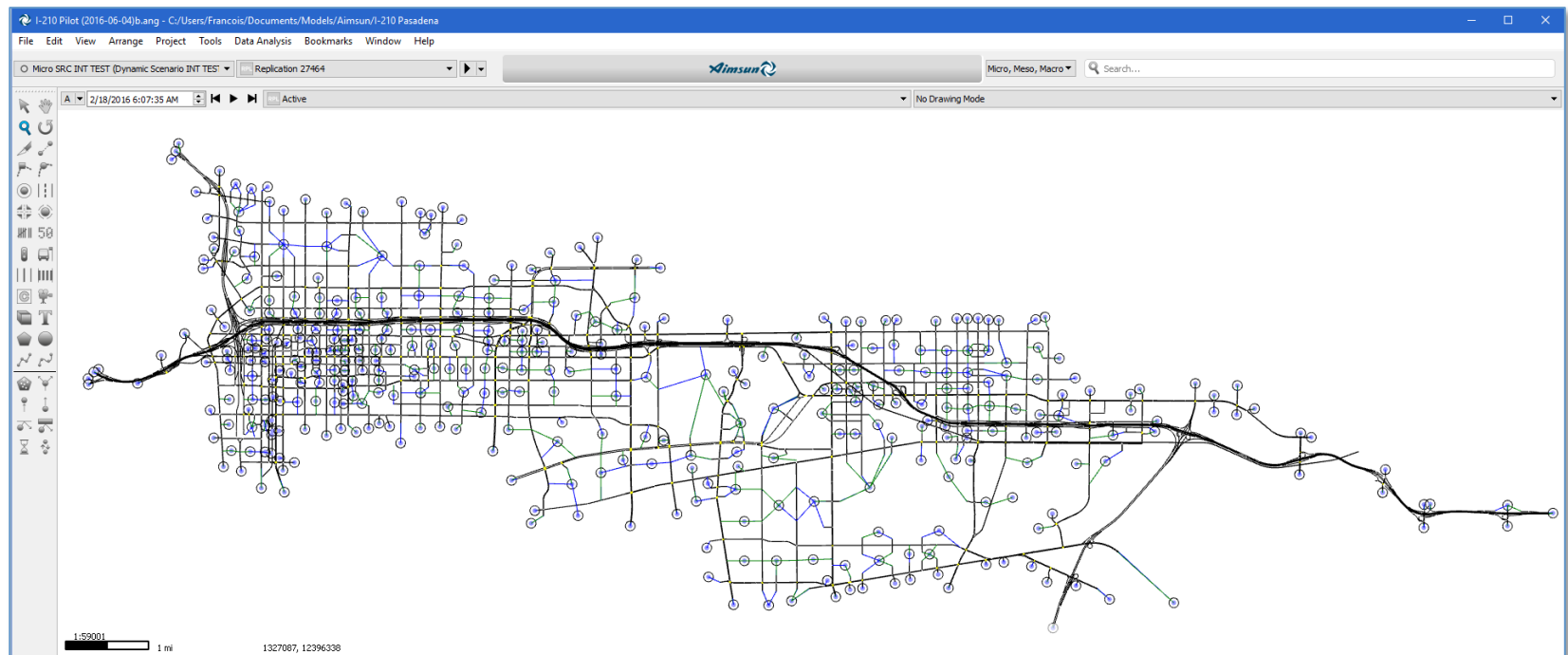☐ **This feedback helped refine the list of wayfinding sign installations**

Simulation Modeling

Aimsun Model

- Modeling of roadways, transit services, and basic control elements complete
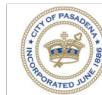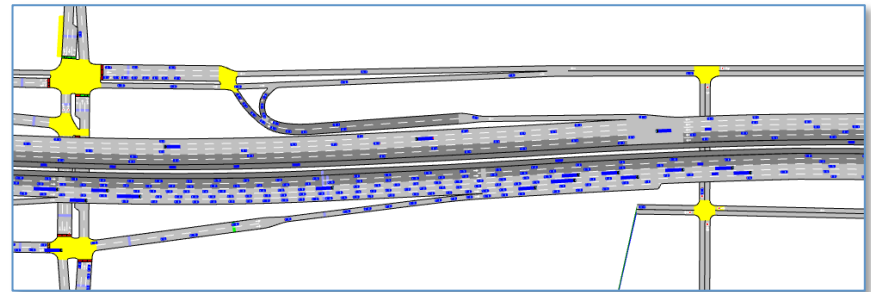
Aimsun Model – Current Activities

- **Demand modeling**

  - Received 2012 SCAG travel demand data two weeks ago – currently processing the data for inclusion in the model

  - Adding traffic count data into the model – to be used for origin-destination demand modeling and calibration

- **Driver behavior calibration**

  - Tweaking driver behavior parameters to better reproduce traffic dynamics at freeway merge, weaving areas, and other bottlenecks

    - Lane changing aggressiveness

    - Acceleration/deceleration

    - Spacing between vehicles

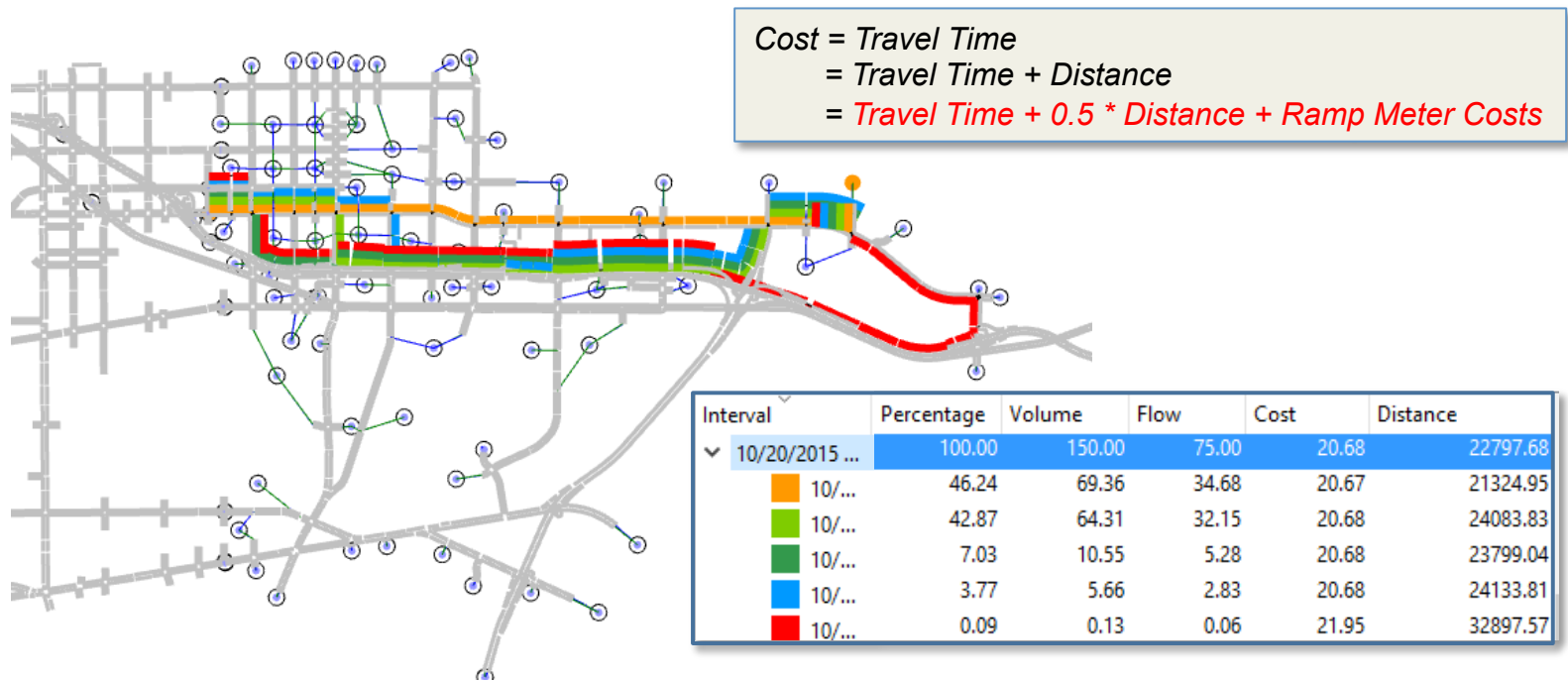   - Influence of slower traffic on adjacent lanes

Aimsun Model – Current Activities

□ **Routing behavior calibration**

    □ Evaluating alternate trip cost formulas to ensure realistic route choices under dynamic scenarios

Cost = Travel Time
    = Travel Time + Distance
    = *Travel Time + 0.5 * Distance + Ramp Meter Costs*

Interval	Percentage	Volume	Flow	Cost	Distance
⌄ 10/20/2015 ...	100.00	150.00	75.00	20.68	22797.68
10/...	46.24	69.36	34.68	20.67	21324.95
10/...	42.87	64.31	32.15	20.68	24083.83
10/...	7.03	10.55	5.28	20.68	23799.04
10/...	3.77	5.66	2.83	20.68	24133.81
10/...	0.09	0.13	0.06	21.95	32897.57

Aimsun Model – Next Steps Activities

- **Development of Origin-destination matrices based on**
  - 2012 SCAG data
  - Information extracted from Pasadena's VISUM model
  - Available traffic counts

- **Calibration of freeway flow performance for AM and PM peaks**
  - Location and extent of bottlenecks
  - Observed speeds

- **October 25: Critique of model by Cambridge Systematics as part of a USDOT funded effort**

Capstone Project at Berkeley

□ **One year Masters of Engineering project for four highly motivated experienced students**

  ◻ 1-5 Years Business experience

  ◻ Ages 22-27

□ **Solving DTA for the I-210 under various incentives**

□ **Would like input from interested modelers at:**

  ◻ SCAG

  ◻ Metro

  ◻ Caltans

  ◻ Cities

Action Items and Next Meeting Time

Thank You