Connected Corridors
Face-to-Face Meeting

Tuesday, March 21st, 2017
1:30 – 3:30 pm
Arcadia

March 21st, 2017

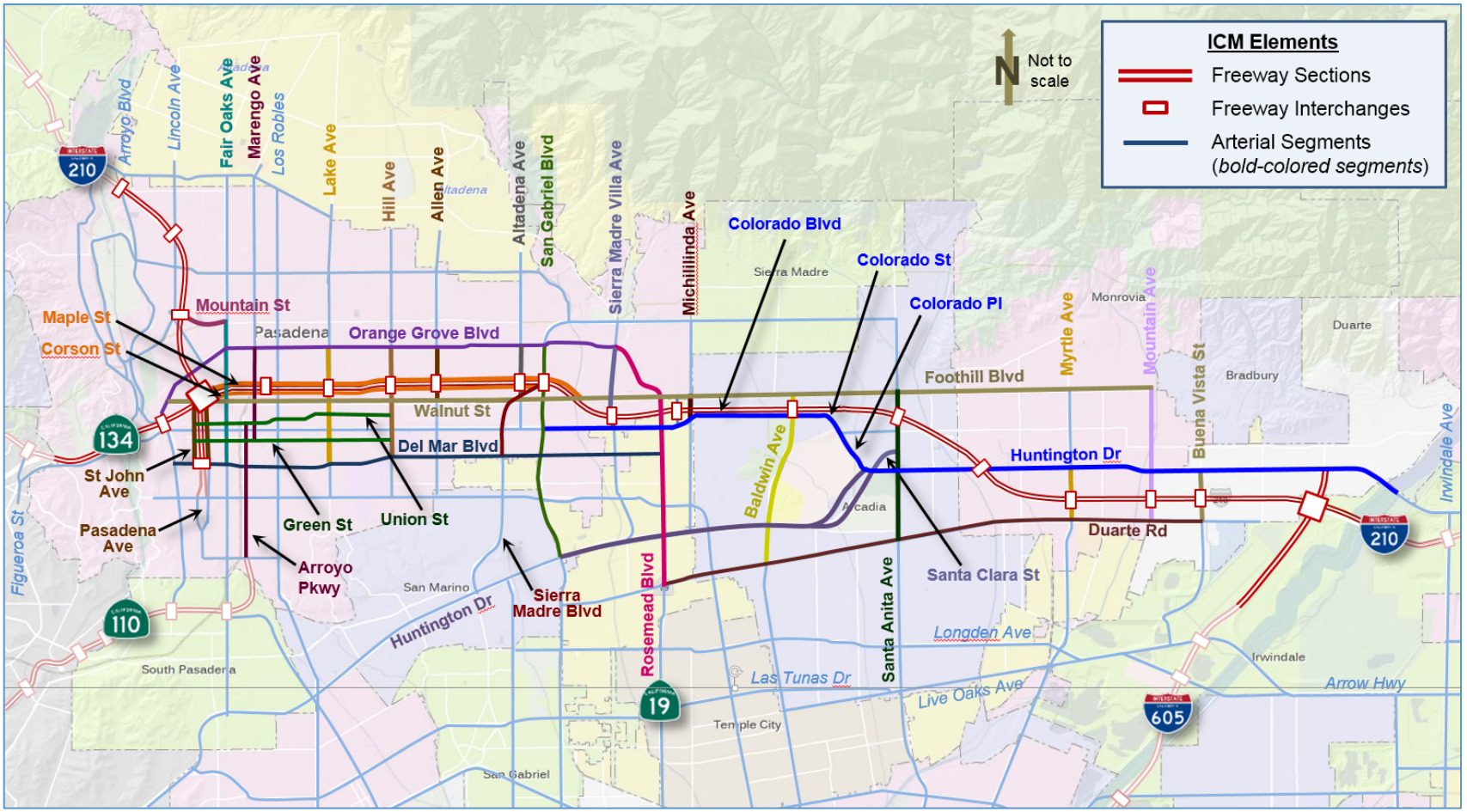
New Faces at Caltrans HQ

- HQ
  - Amarjeet Benipal – Acting Division Chief for Traffic Operations
  - Brian Simi has returned to HQ
- D7
  - Homar Noroozi has been appointed as Traffic Management Principal
  - Allen Chen has been promoted to Office Chief for ITS

Agenda

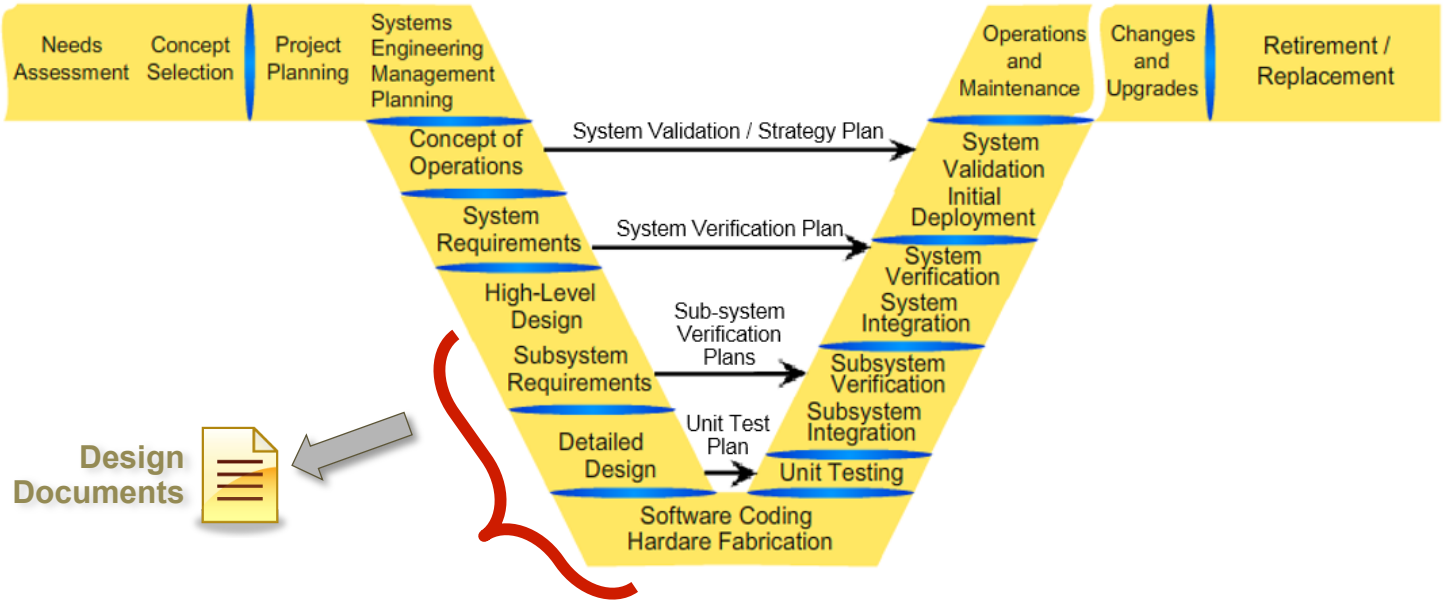
- Introductions
- Schedule Review
- Outreach
- High Level Design and Implementation
- Data Quality and Estimation
- Modeling and Response Planning
- Action Items and Closing

Our Corridor: The I-210

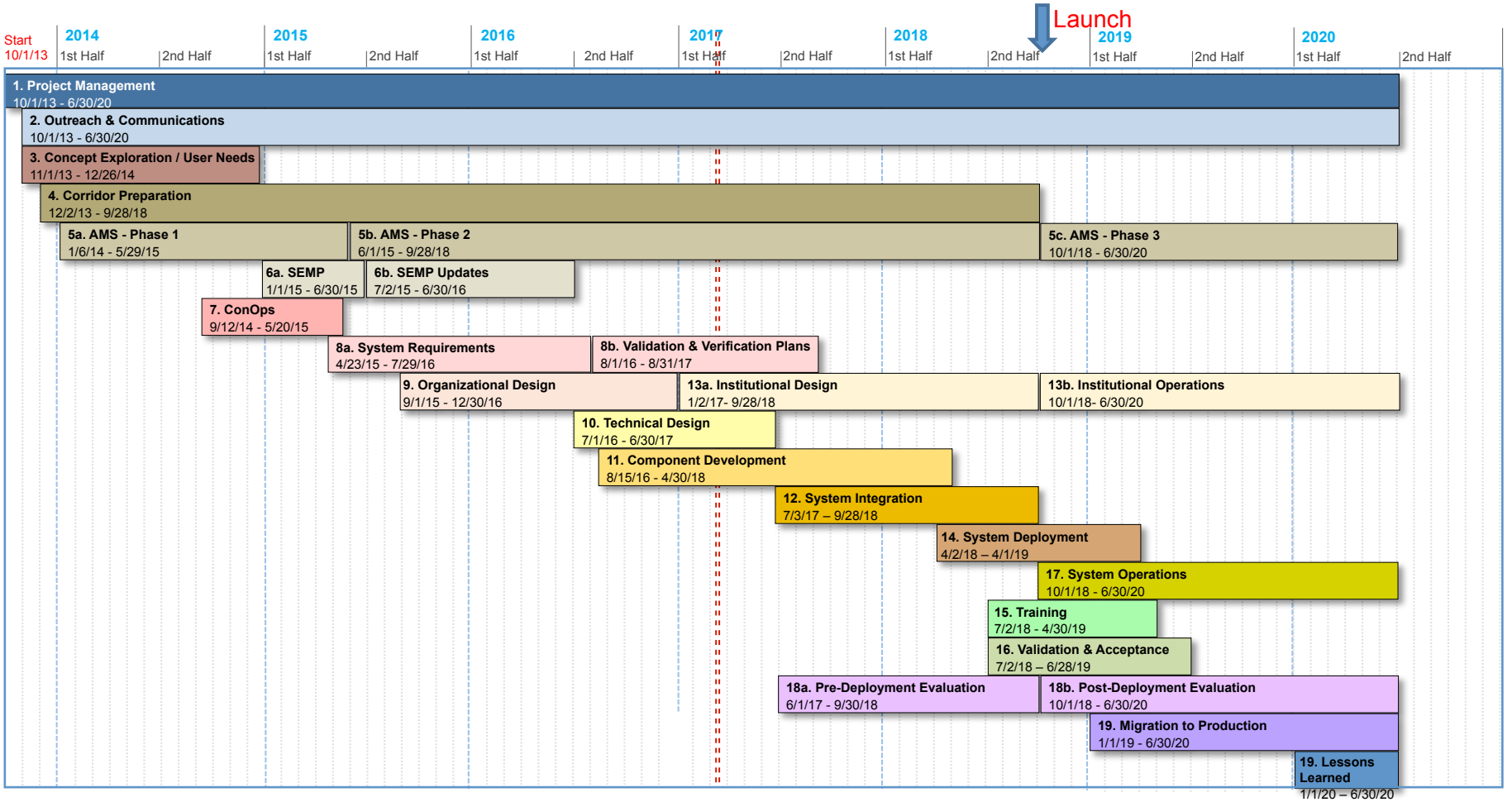


Systems Engineering Next Steps

- **Design Documents – How will the requirements be met**
- **Hardware and Software – Building the system**



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

Stakeholder Involvement

- **We are now in a phase where we will be more involved with stakeholders**
  - Model reviews
  - Response plan generation
  - Call for Projects installation details
  - Data Quality
  - Demonstrations of functionality
  - Software installations
  - Communications upgrades
  - Memorandum of Understanding/Agreements
  - Roles and Responsibilities
  - Outreach, demonstrations, and presentations

8

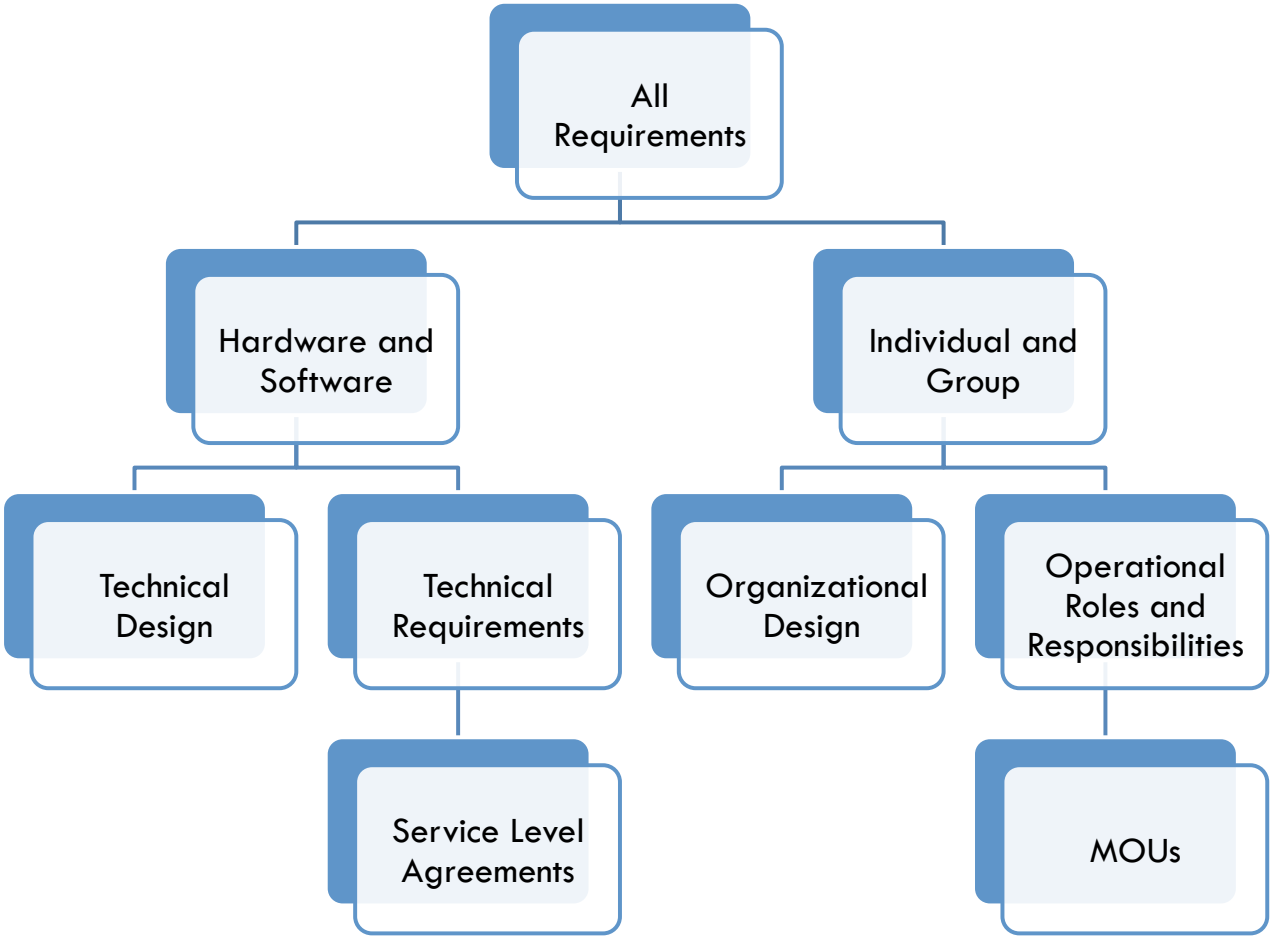
Outreach and Communications

Outreach

- **Spring Connected Newsletter – articles being written; distribution in late April**
- **CC Statewide Rollout website – site reorganized and under review; final content being written**
- **5 abstracts submitted for ITS CA conference in September in SF**
  - Not by Technology Alone: People and Organizations in ICM
  - Changing a State One Corridor at a Time (Update on the I-210 Pilot)
  - Real Time Data Hub for Corridor Operations
  - Building a Large-Scale Simulation Model for the I-210 DSS
  - Cloud Deployment of Corridor Management Systems

High Level Design

High Level Design



Subsystem schedules

			2017				2018			
			1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
Personnel								Integrate System	Test System	Run and Refine System
	Caltrans,PATH	**Personnel/Orgs**	Design	Assign	Assign	Assign	Trial Ops			
Hardware and Construction	Caltrans, RIITS, PATH	**Fiber Comm & Cloud**	Design	Design	Build	Build	**Integrate Subsystems using specs and sample implementation and hardware**			
	Caltrans, Cities, County, Metro	**Arterial Call For Projects**	Design	Build	Build	Build				
	Caltrans	**Freeway Shopp**	Build	Build	Build	Complete				
Core SubSystems	PATH, Caltrans	**Cloud Infrastructure**	Design	Build	Build	Build				
	PATH, Caltrans	**Data Hub**	Build	Build	Build	Build				
	PATH, Vendors	**COTS (Purple Box)**	Contract	Select	Design	Build				
New systems or Significant Upgrades	LAMetro	**RIITS Video**	Design	Design	Build	Build				
	Caltrans	**Caltrans Video**	Contract	Install	Test					
	Caltrans	**PEMS**	Design	Contract	Build	Build				
	Caltrans	**ATMS**	Design	Contract	Build	Build				
	Caltrans, Cities, County	**Sign Control**	Design	Build	Build	Build				
C2C Interfaces	PATH, Caltrans, Pasadena	**McCain**	Design	Build	Build	Build				
	PATH, Caltrans,County	**Kimley-Horn**	Design	Build	Build	Build				
	PATH, Caltrans, Arcadia	**Transcore**	Design	Build	Build	Build				
	PATH, Caltrans	**TSMSS**	Design	Build	Build	Build				

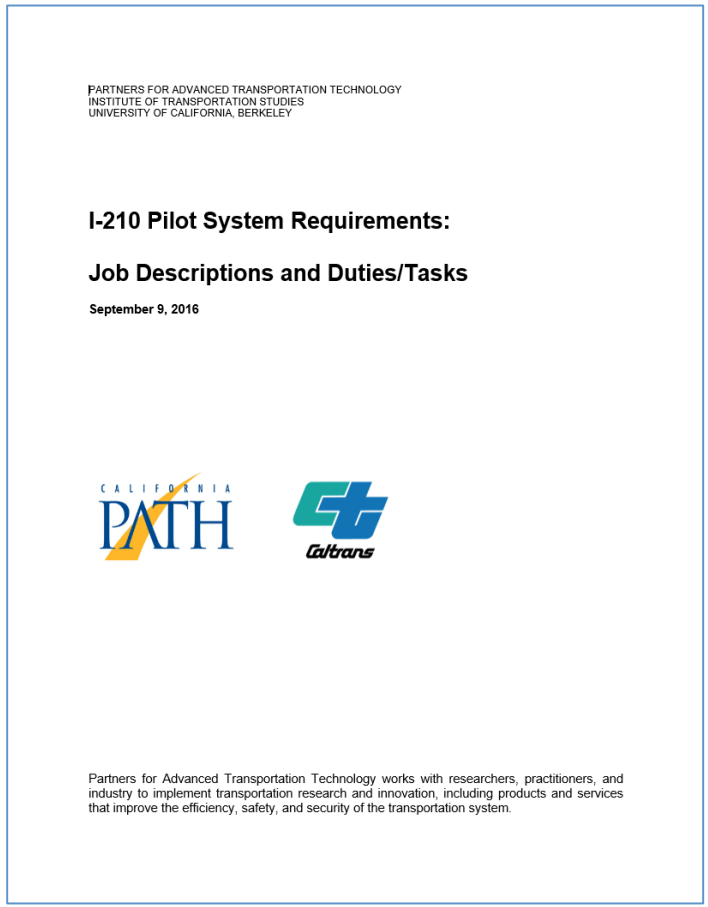
Subsystem schedules

			2017				2018			
			1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
							Integrate Subsystems using specs and sample implementation and hardware	Integrate System	Test System	Run and Refine System
Mostly Interfaces	Caltrans, PATH	**Closures**	Deploy	Test	Choose	Refine				
	LAMetro, PATH	**511**		Design	Build					
	LAMetro, PATH	**RIITS/Transit**		Design	Build					
	LAMetro, PATH, Caltrans	**Environmental**	Design	Design	Build	Build				
	Cities, County, PATH	**Travel Time**	Design	Design	Build	Build				
Data	PATH, Cities, County	**City Data**	Add	Add	Quality	Quality	Load Data and Integrate with Data Hub			
	Caltrans,PATH	**Caltrans' Data**	Quality	Quality	Quality	Quality				
AMS/DSS	PATH	**Estimation**	Build	Build	Complete	Update				
	PATH	**Simulation**	Build	Complete	Update	Update				
	PATH	**Prediction**	Build	Build	Complete	Update				
	PATH	**Rules Engine**	Design	Build	Build	Build				
	PATH, Caltrans, Cities, County	**Rules**	Gather	Gather	Gather	Gather				
	PATH, Caltrans, Cities, County	**Response Plans**		Design	Design	Design				
PATH Contracts	Caltrans	**Data Hub**	Contract	Contract	Award					
	Caltrans	**Next Contract**	Contract	Contract	Contract	Contract	Award			

Risk Reduction - Interface Implementations

- **For all subsystems, in order to maintain our schedule and start subsystem integration in January of 2018, we agreed that by the end of 2018:**
  - Data (not UI) Interfaces are well defined
  - Sample software interface implementations with sample data are available
  - For hardware, at least one hardware element is available for testing

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
- TMC/TCS Operators
- Transit Field Supervisors
- Public Information Officers
- First Responders
- Outreach and Communications Manager

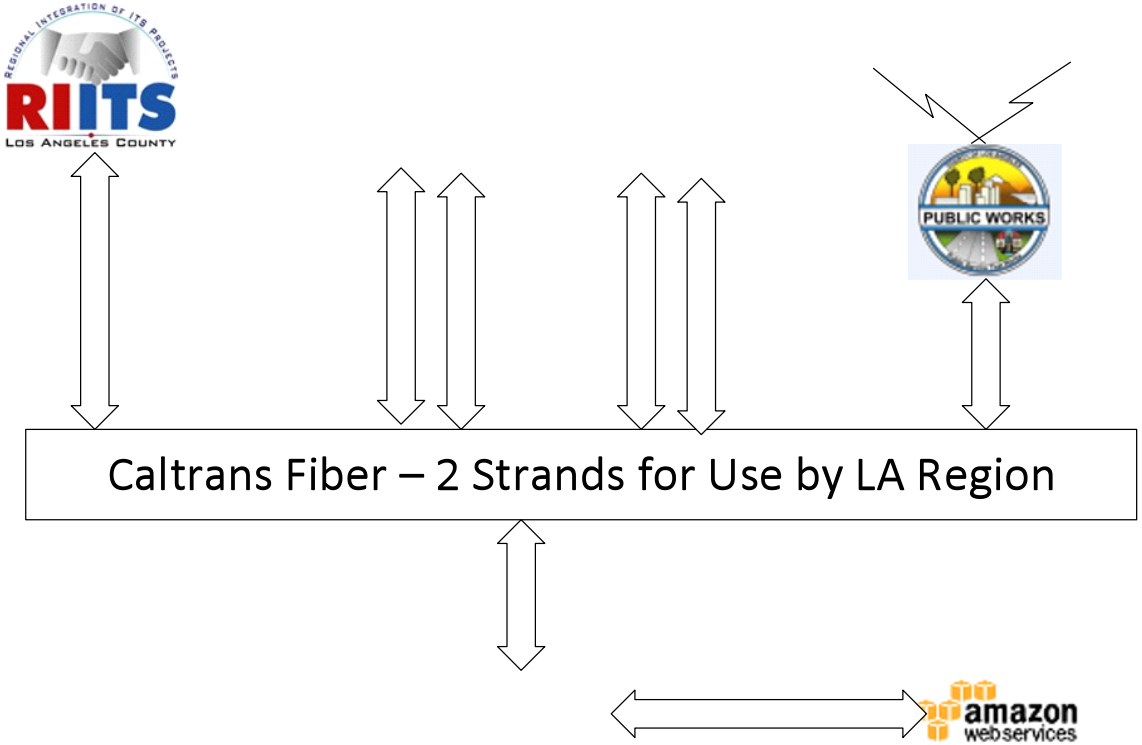
Job Roles and Responsibilities

- **Caltrans has completed assigning roles/personnel to the job roles and responsibilities (high level)**
- **The "Needed for Pilot" column has been completed**
- **Next steps**
  - Caltrans is reviewing a table of needed tasks and the timeline to move the project forward

Job Descriptions and Duties/Tasks Schedule for Continued Work (draft)

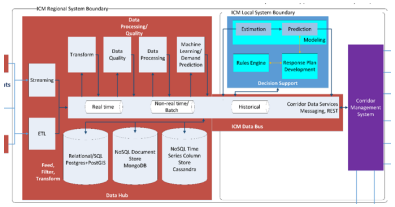
	Caltrans D7	PATH	By When
Finish adding the color-coding for the 4 roles identified by CT and update the appendix		Fred	3.17
Add a legend to explain the color-coding		Fred	3.17
Determine whether STE or ITS is someone from the System Management and Evaluation Office or the ITS group (the "Who" column currently has both listed in some cases)	Rafael		
Further delegate CT tasks to new hires in D7	Rafael		
Review initial job titles drafted by PATH and match job titles to CT personnel	Rafael	Lisa	
Identify transition plan for the PATH (P) tasks (who will do the task at CT D7)	Rafael		
Determine when the tasks above would transition from PATH to D7 (Q/Yr)	Rafael		
Write summary of what the four D7 offices do (so that other CT districts can use similar office functions in their Corridor projects)	Rafael		
Review the Stakeholder (S) tasks and determine if they will stay with Stakeholders for the duration of the project (or transition)		Lisa	3.17
Review the Job Descriptions document and determine when D7 personnel will be on board and trained to perform CT tasks in the document (prior to the launch of the I-210 Pilot in late 2018).	Rafael	Lisa	

Fiber and Cloud Communications



Questions

1) Purple Box UI
2) Blue Tooth Servers
3) Other Data – Sensys, etc.



Metro Call for Projects

- **Metro Call for Projects**
  - Contract Status
    - Agreements are in legal at both Caltrans and Metro
    - No issues anticipated
  - Procurement: Starting later than desired
    - Planning on using a Service Contract to deliver project elements
    - Awaiting word from DPAC

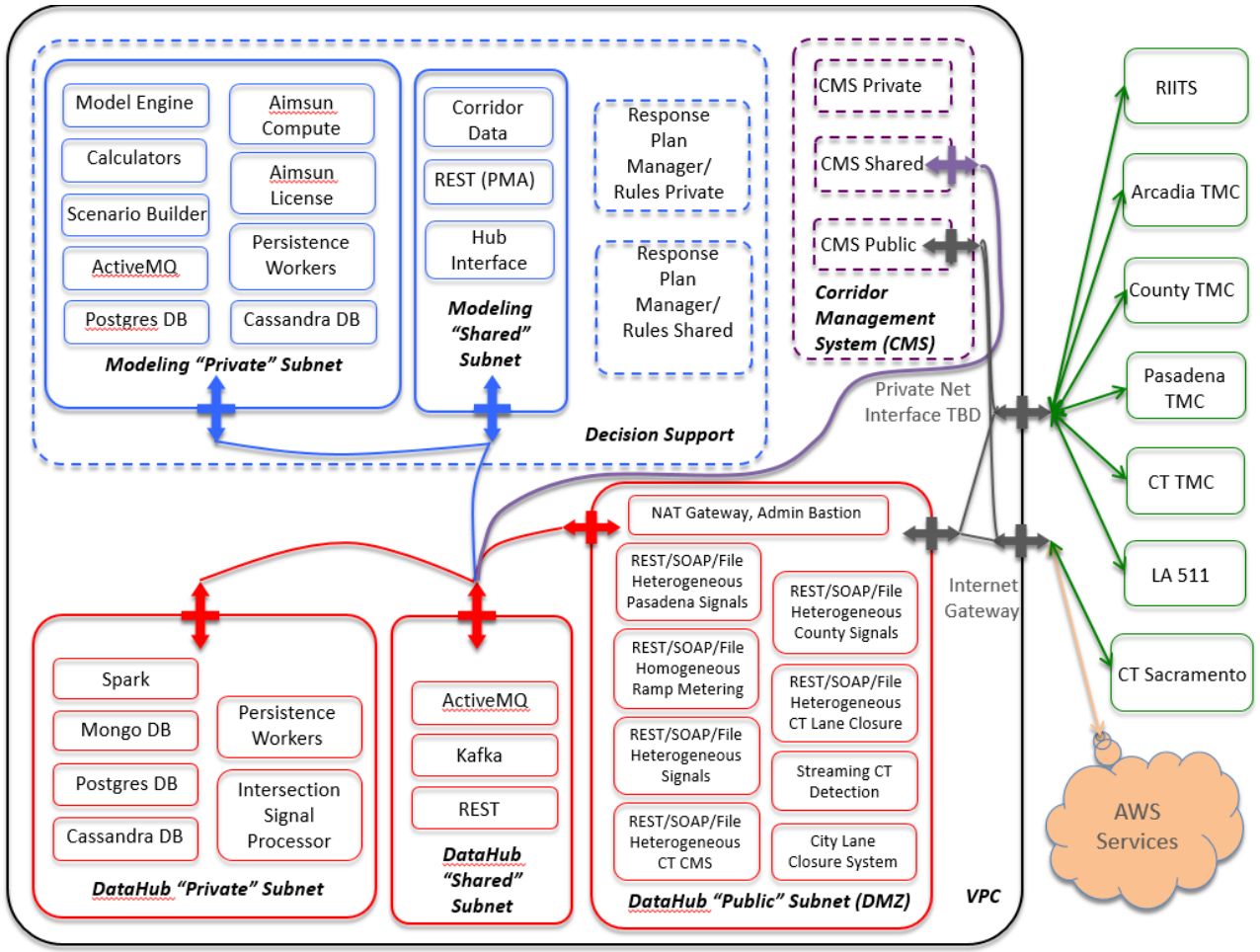
I-210 SHOPP Construction Project Update

- **The project is on schedule to deliver Phase 1 (CC area) by end of 2017**
- **Must ensure that contractor will let us use the system prior to end of contract**

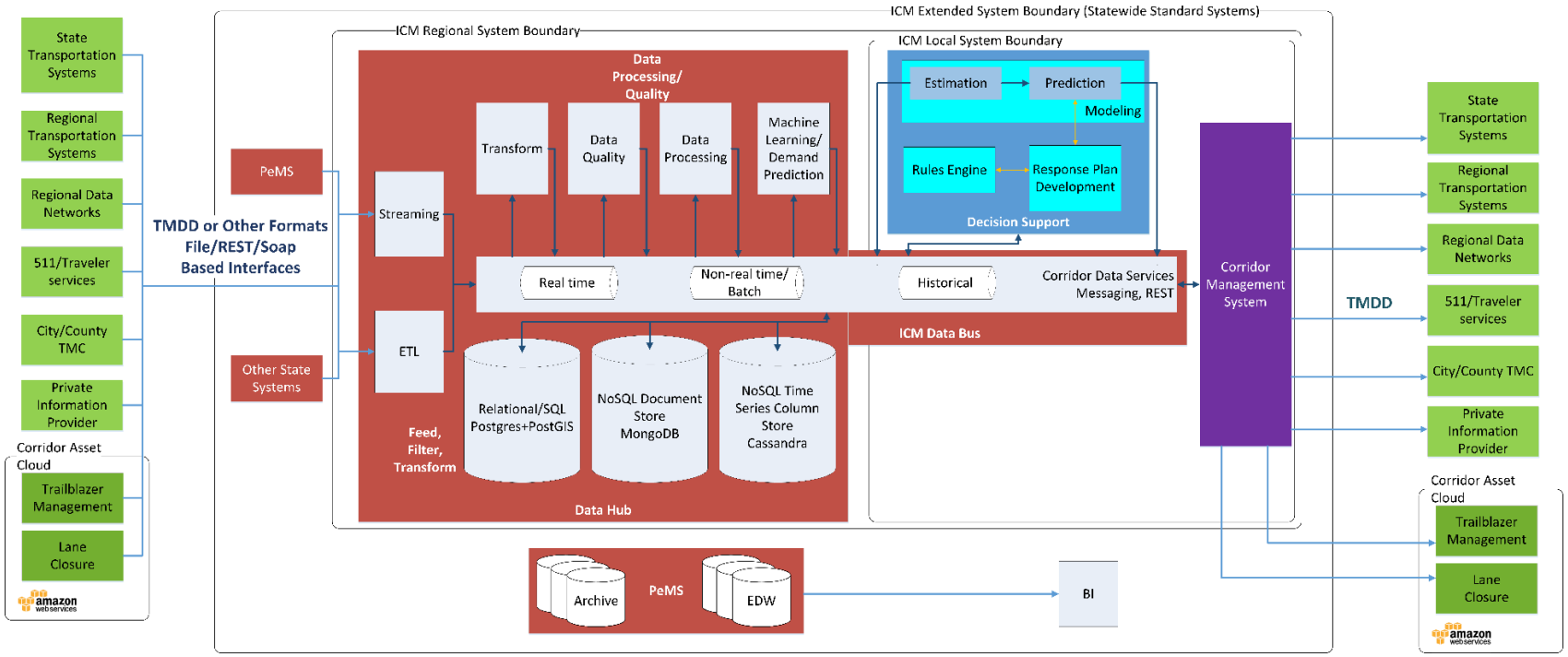
Items of Note

- Reviewed ITS Architecture and some updates required
- Data hub design and other aspects of system reviewed by Irvine Global Consulting
- Caltrans IT AWS Training happening today
- Mike to review CC with Caltrans IT security

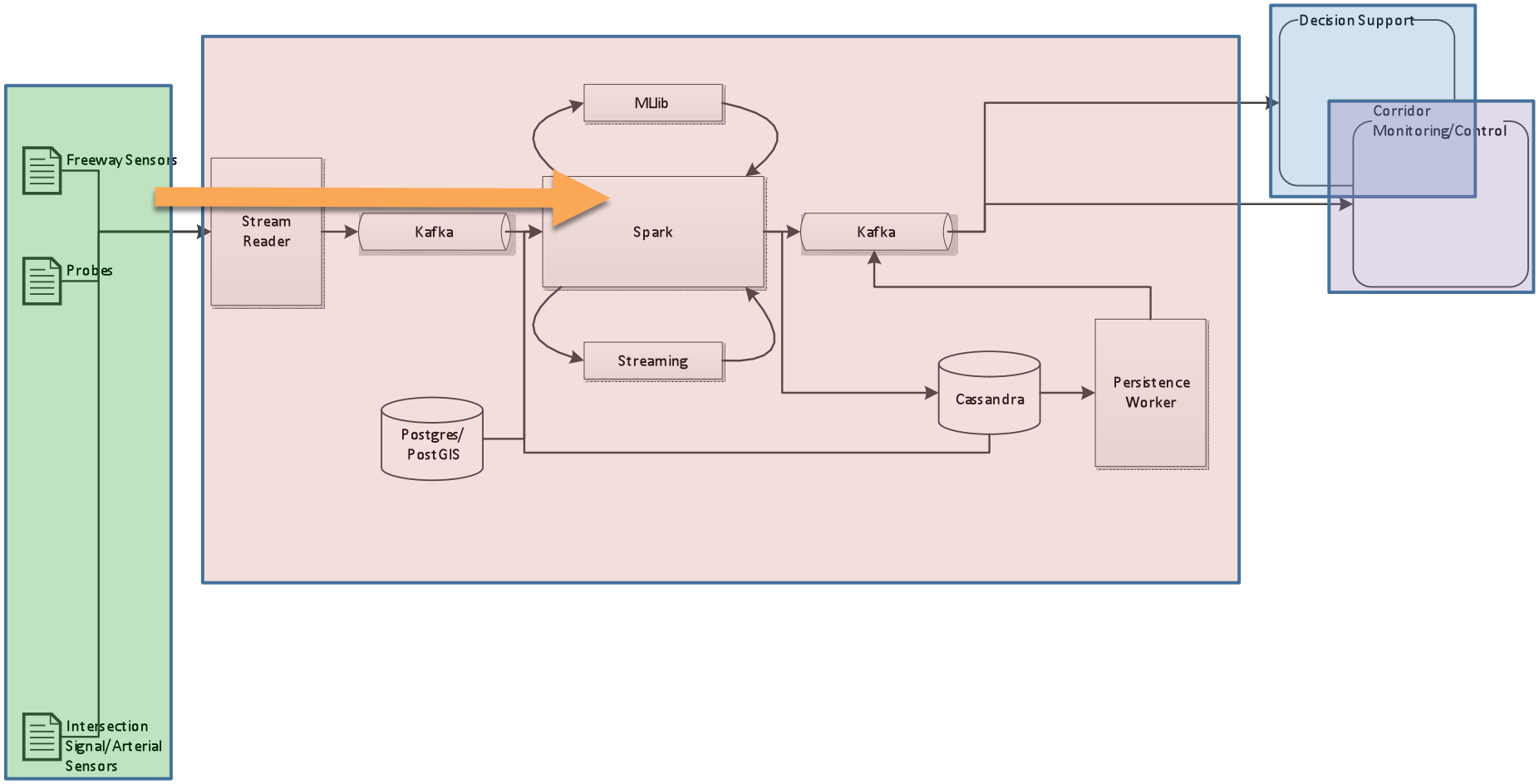
Amazon Cloud Infrastructure



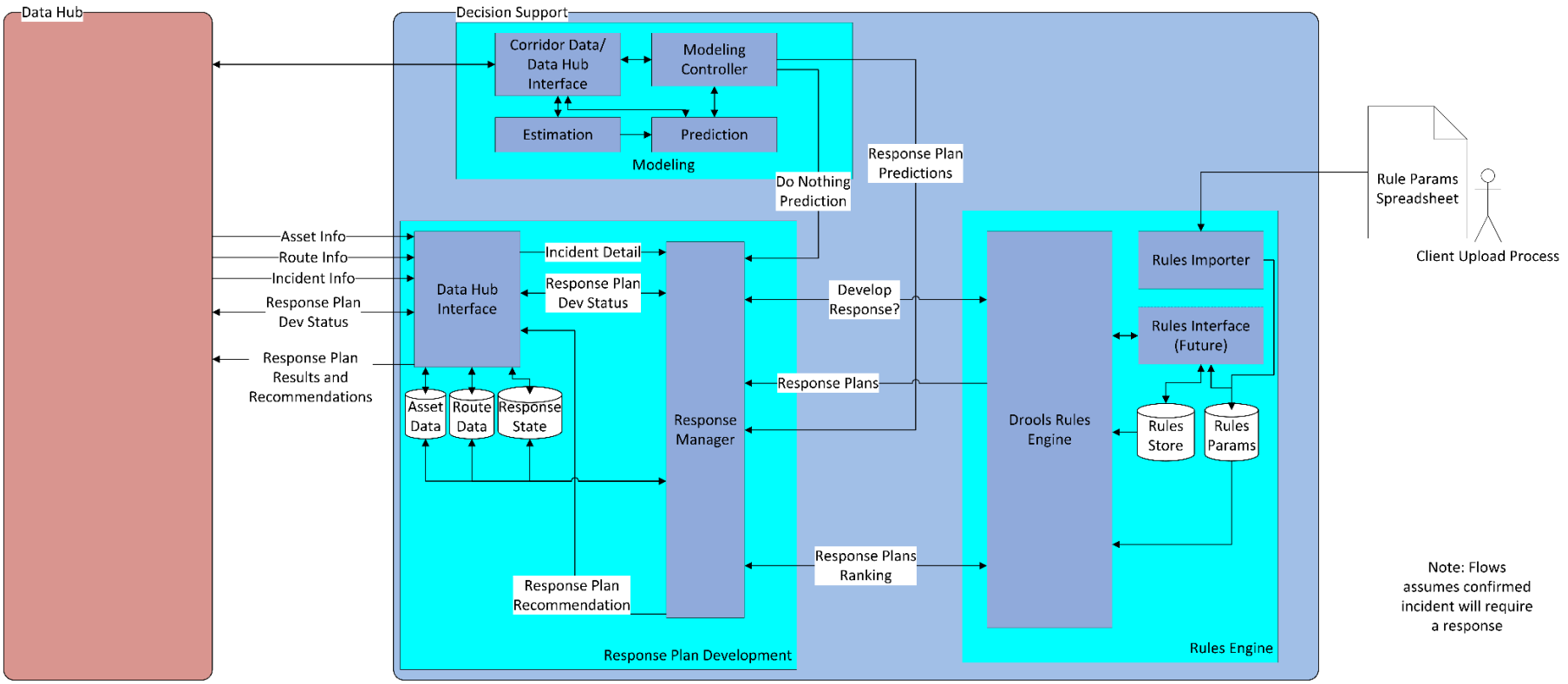
Data Hub and DSS within the cloud



Data Hub Streaming Progress



DSS – Design Detail



Proof Of Concept – COTS (Purple Box)

- **Released RFP yesterday**
  - Live on CC and ccdocs websites
  - Have begun mailing to companies
  - Will be listed in ITS member newsletter
  - Will be sent to the Connected Newsletter mailing list
- **Anyone can download the RFP but must register to obtain the actual requirements documents**
- **Requirements include a column that vendors must use to indicate whether they will meet, partially meet, or not meet**
- **Thus far Kapsch, Parsons and Irving Global Consulting have requested documents**

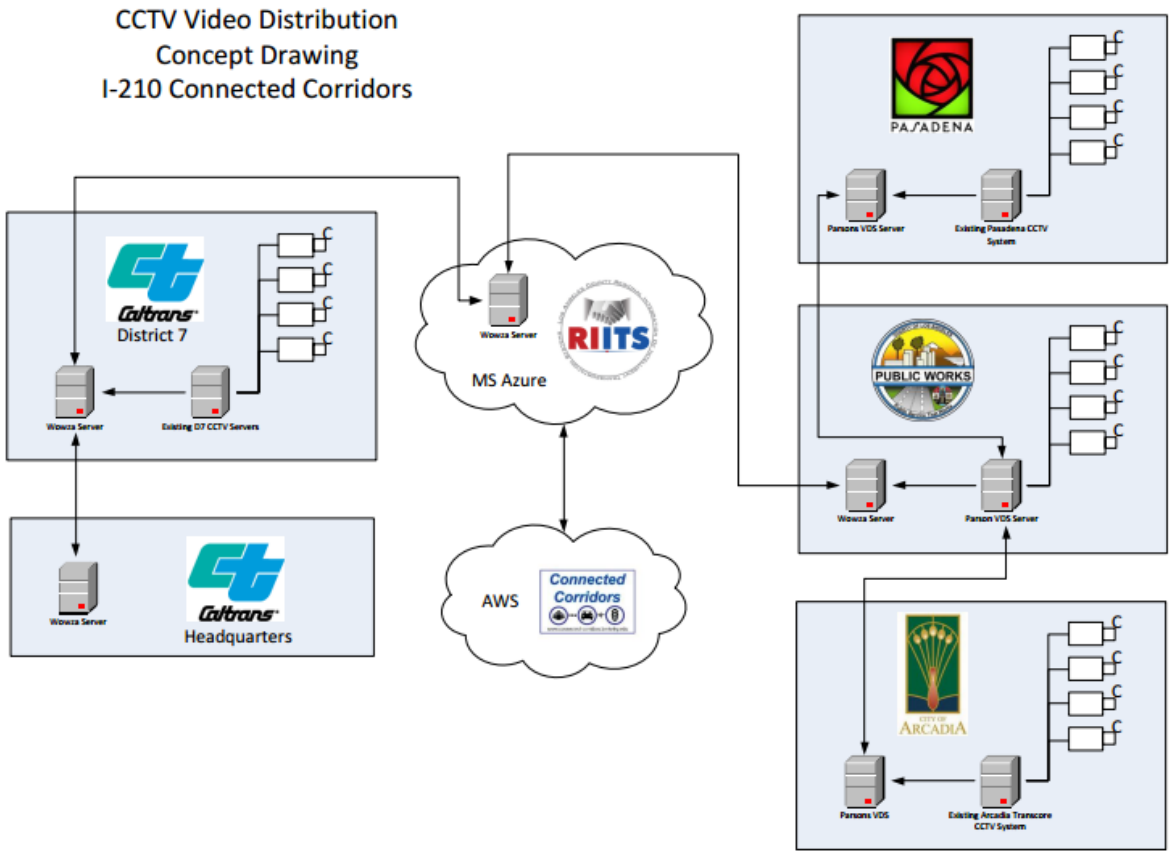
Proof of Concept Dates

- March 2017 – Release of this document
- April 2017 – Outreach event to address questions
- May 8th 2017 – Receive responses from vendors
- June 2017 – Choose vendors who will participate in pilot
- August 2017 – Complete agreements with vendors as needed
- Sept 2017 – Begin integration planning with vendors
- Nov 2017 – Begin integration of vendor COTS products
- Oct 2018 – Launch pilot utilizing COTS software of first vendor
- Feb 2019 – Complete Integration of second vendors COTS software
- May 2019 – Complete Integration of third vendors COTS software

The anticipated schedule for Caltrans procurement is:

- May 2018 – Caltrans will begin internal procurement process
- Oct 2019 – Procurement document released
- April 2020 – COTS vendor chosen
- July 2020 – Complete contractual negotiations
- Nov 2020 – Install production software

Video Distribution



ATMS, PEMS, Lane Closure

- **ATMS Upgrades – (High Priority, High Risk)**
  - Procurement cycle may result in late contract start
  - HQ trying to accelerate contract
- **PEMS**
  - Awaiting quote from vendor
- **Lane Closure**
  - Mike Jenkinson should be providing a link in the near future

C2C - McCain

- McCain provided yesterday
  1. A test TMDD-based service for developers in this project to communicate with. The address is contained in the attached ICD.
  2. An Interface Control Doc (attached) to describe McCain's specific implementation of the TMDD-based service, including custom extensions that may or may not be needed as part of the ultimate solution for this project.
  3. Sample source code demonstrating how to connect, query, and subscribe to data via the TMDD-based service.
- They would like us to review and test this before providing us with a quote

C2C – Transcore

- Determine they do not have a readily available C2C package
- They will provide a quote for modify an internal product at the end of the month

C2C – Kimley-Horn

- Provided spec for interface being used by D4
  - Missing sensor data
- Meeting being arranged to determine next steps

Update on RIITS and 511

- RIITS
  - PATH will participate in the design review process for RIITS management of information exchange
  - RIITS agrees to provide a mechanism for PATH to provide data to a location from which the 511 team can retrieve that data. Target Date is August 2017.
  - RIITS agrees to investigate with PATH the logging of data actions
- 511
  - 511 will provide a suggestion for the format and structure of the messages from the CC ICM system.
  - 511 will also provide a suggestion for the format and structure of a validation messages. This may include metrics of how many people it was forwarded to.

Travel Time and Environmental

- **Travel Time**
  - Awaiting Call for Projects agreement to begin work with vendors
- **Environmental**
  - Equipment will be placed on freeway in or near call boxes
  - Data will be sent to RIITS
  - RIITS will pay for communication costs

Data Quality and Estimation

Freeway Sensor Availability

Weekly Average Sensor Availability

Hover over cells to view units in detector-days.

I-210 ▾ Eastbound PM 25 - PM 43.25 ▾

		CD	CH	Fwy-Fwy	HOV	Mainline	Off Ramp	On Ramp	Total
February	5 6 7 8 9 10 11			47.6%	90.2%	91.1%	98.0%	97.1%	91.4%
	12 13 14 15 16 17 18			66.7%	94.3%	93.6%	91.7%	96.0%	93.1%
	19 20 21 22 23 24 25			66.7%	95.1%	93.2%	95.7%	96.0%	93.4%
	26 27 28 1 2 3 4			66.7%	91.0%	89.6%	93.8%	90.3%	89.8%
March	5 6 7 8 9 10 11			66.7%	78.4%	78.2%	78.6%	73.1%	77.5%
	12 13 14 15 16 17 18			66.7%	80.4%	80.5%	82.4%	76.0%	79.9%

Weekly Average Sensor Availability

Hover over cells to view units in detector-days.

I-210 ▾ Westbound PM 25 - PM 43.25 ▾

		CD	CH	Fwy-Fwy	HOV	Mainline	Off Ramp	On Ramp	Total
February	5 6 7 8 9 10 11	0.0%		85.7%	80.5%	85.5%	96.7%	96.4%	86.9%
	12 13 14 15 16 17 18	0.0%		100.0%	87.2%	89.8%	86.9%	94.4%	89.7%
	19 20 21 22 23 24 25			100.0%	88.0%	89.5%	84.8%	94.9%	89.6%
	26 27 28 1 2 3 4			100.0%	84.2%	83.2%	77.0%	86.2%	83.4%
March	5 6 7 8 9 10 11			100.0%	75.9%	77.2%	69.6%	76.0%	76.7%
	12 13 14 15 16 17 18			100.0%	78.6%	80.3%	72.8%	80.6%	79.8%

- It appears that the time between failures for the analog communication system is too short to maintain effective data quality
- We look forward to the installation of digital technology

Arcadia

Weekly Average Sensor Availability *Hover over cells to view units in detector-days.*		Arcadia ▾								
		Detour Routes			Non Detour Routes			All Detectors		
		Good	Bad	No Data	Good	Bad	No Data	Good	Bad	No Data
	8 9 10 11 12 13 14	62.7%	31.5%	5.8%	28.3%	16.6%	55.2%	54.1%	27.7%	18.2%
	15 16 17 18 19 20 21	63.0%	31.3%	5.8%	29.0%	15.9%	55.2%	54.4%	27.4%	18.2%
	22 23 24 25 26 27 28	62.3%	31.9%	5.8%	29.0%	15.9%	55.2%	53.9%	27.9%	18.2%
	29 30 31 1 2 3 4	63.0%	31.3%	5.8%	18.6%	26.2%	55.2%	51.8%	30.0%	18.2%
February	5 6 7 8 9 10 11	63.2%	31.0%	5.8%	18.6%	26.2%	55.2%	52.0%	29.8%	18.2%
	12 13 14 15 16 17 18	63.2%	31.0%	5.8%	18.6%	26.2%	55.2%	52.0%	29.8%	18.2%

- Now that we are receiving County, Monrovia, and Duarte data we should be able to start looking at the quality of that data also
- Looking forward to Pasadena data

Real Time Corridor State Estimation

- **As a reminder, data quality ultimately is used to:**
  - Indicate where data is missing
  - Indicate bad data for removal
- **Estimation fills in:**
  - Where there are no sensors
  - Where data is missing
  - Where the data was bad
- **Progress on Estimation**
  - Anticipate full estimation of corridor in June
  - Need Pasadena data to complete by that date

Corridor Model Update

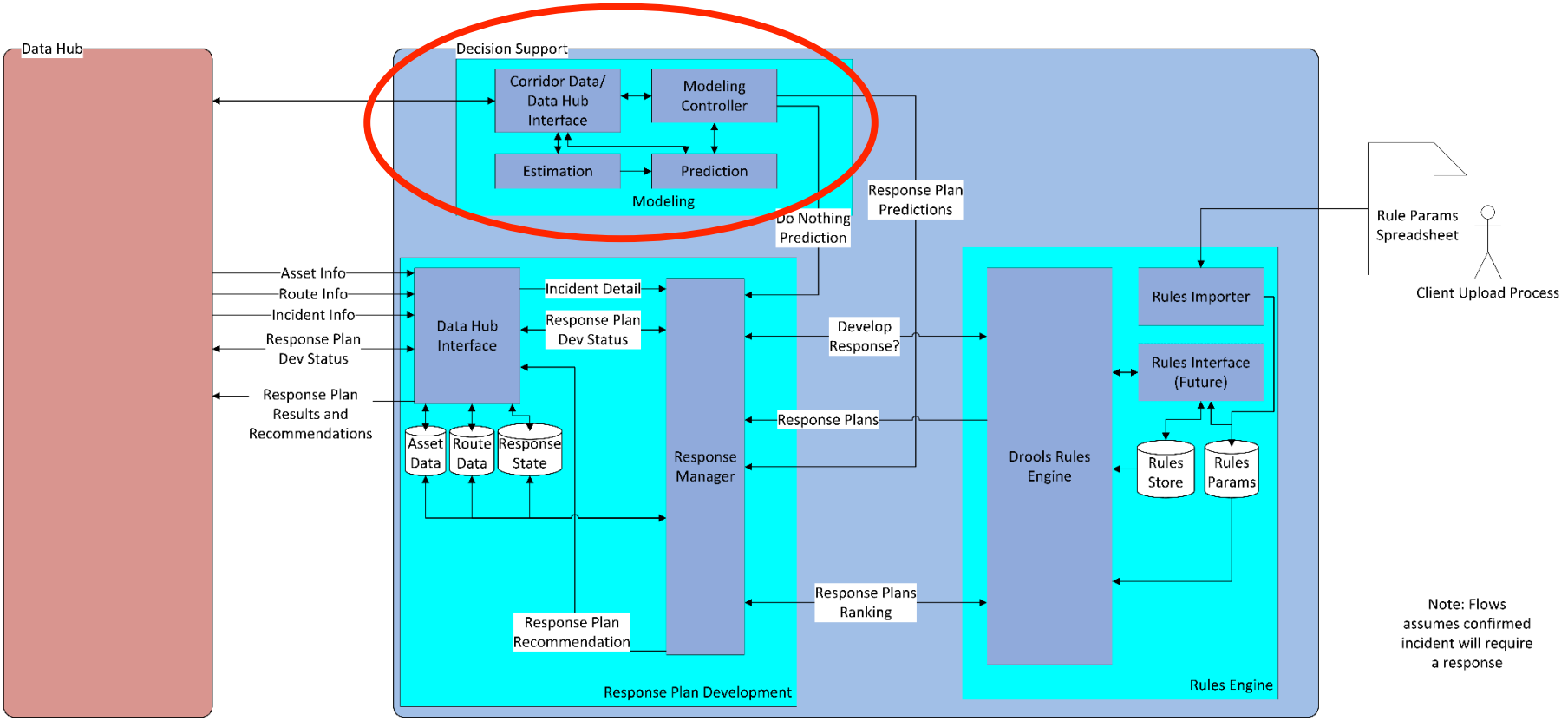
Purpose of Model

- **Pre-planning**
  - To inform and validate the process of building incident response plans
- **Real-time**
  - To score a response plan for use by the Decision Support System
- **Retrospective**
  - To improve response plans and prediction capabilities
- **Special planning**
  - To inform other special planning needs
- **Outreach and Stakeholder support**
  - Model is a visual demonstration of progress and builds confidence

Response Plan Schedule

- **March: Stakeholders review model in detail – Meetings went well**
- **April: Modifications are made as needed**
- **May: Response plan development begins**
- **June: First detailed response plans including signal timing are modeled and reviewed with stakeholders**
- **July: Modifications are made**
- **July: First approved response plan is completed**
- **August and forward: Response plans for remainder of corridor are generated, modeled, and approved**

DSS – Design Detail



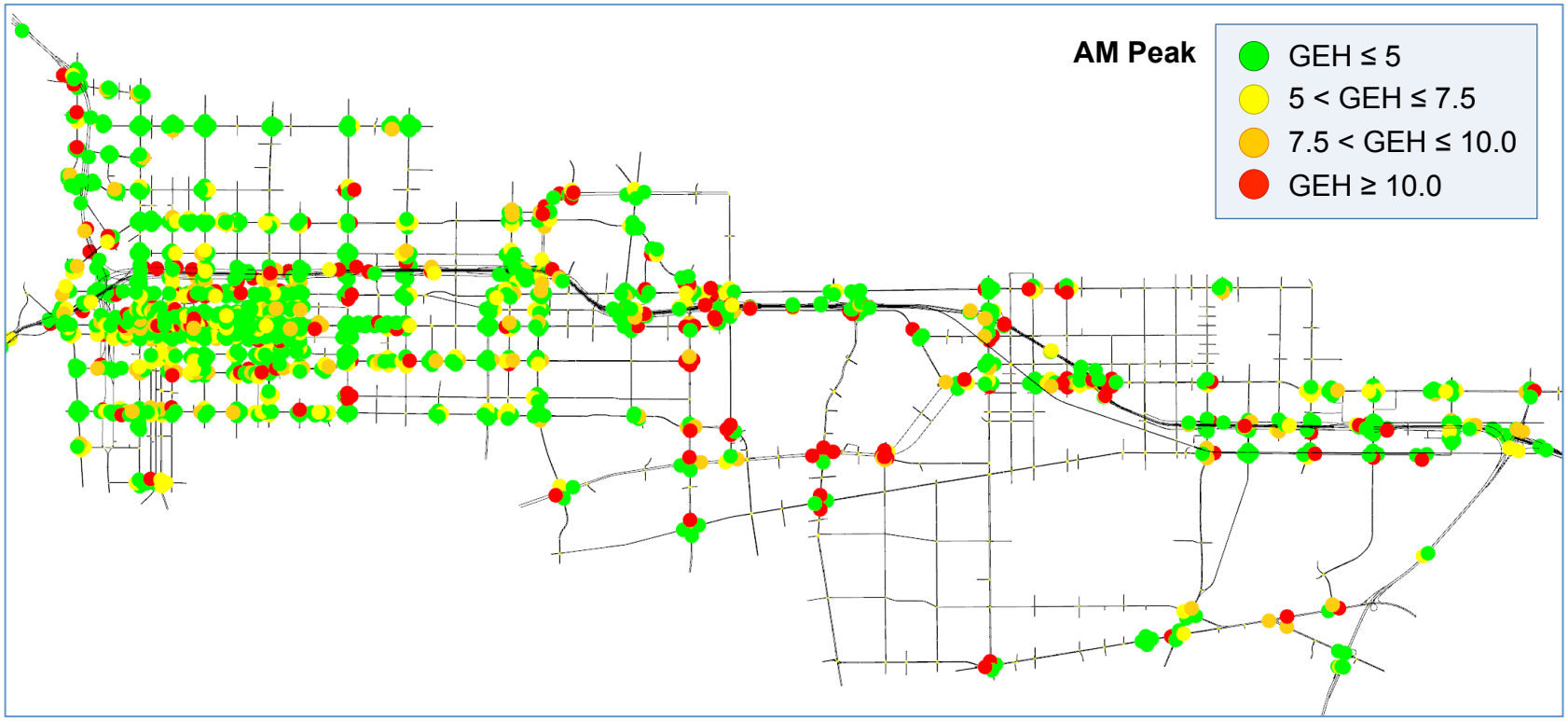
Simulation Model – Current Status

- **Completed elements**
  - Road geometry
  - Traffic control elements
    - Traffic signal operations
    - Ramp metering control
    - Truck restrictions
    - School zones
  - Transit elements
    - All bus routes
    - All bus stops
  - Traffic demand
    - General vehicle behavior
    - Travel cost formulas

- **Elements being refined**
  - Traffic demand
    - Origin-destination flows for AM/ PM peaks
    - Traffic flow profiles for AM/PM peaks
  - Driver behavior
    - Lane-changing parameters
  - Decision-support elements
    - Coding of approved detours
    - Coding of changeable sign locations

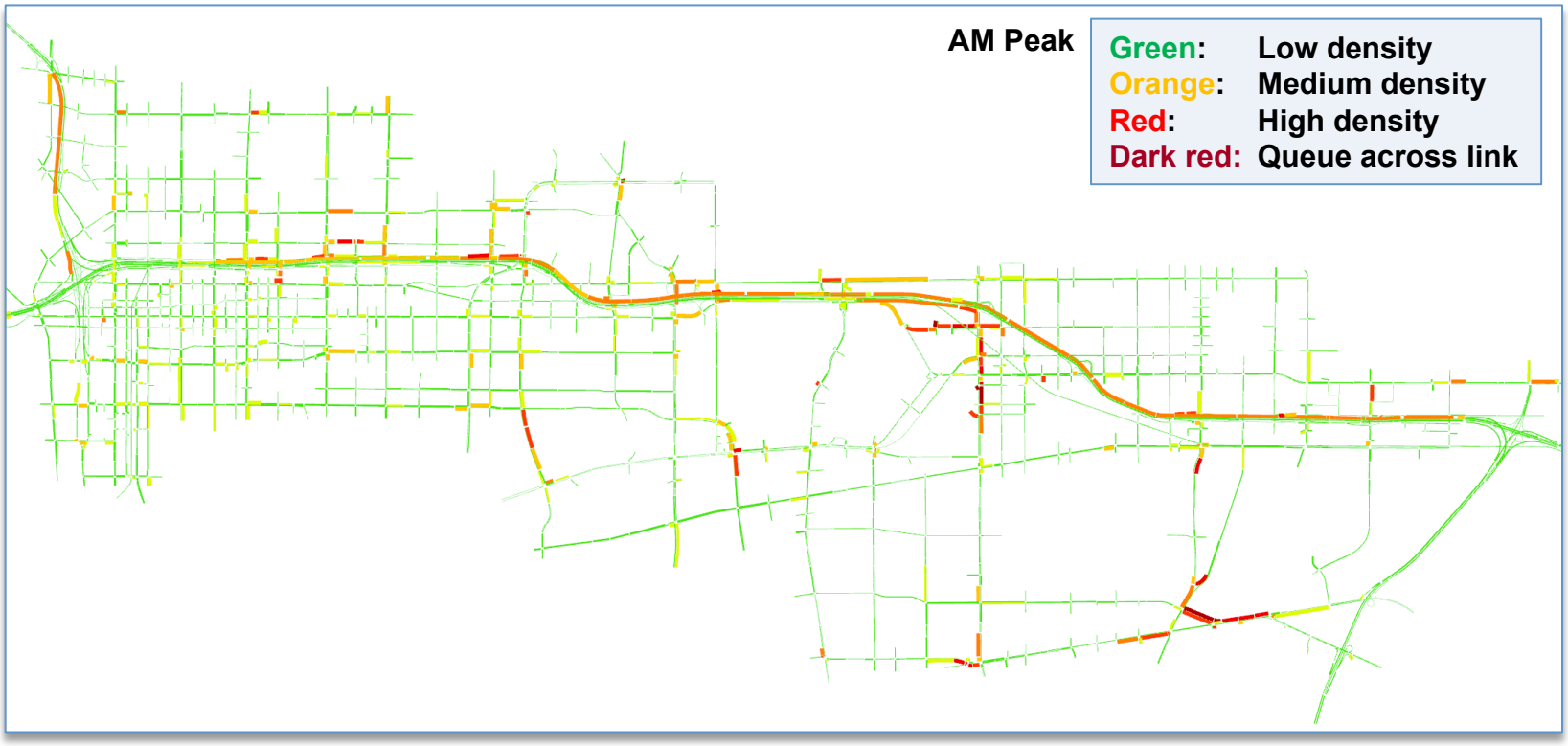
Simulation Model – Current Status

- **Example 1: Verification of simulated vs observed traffic volumes**



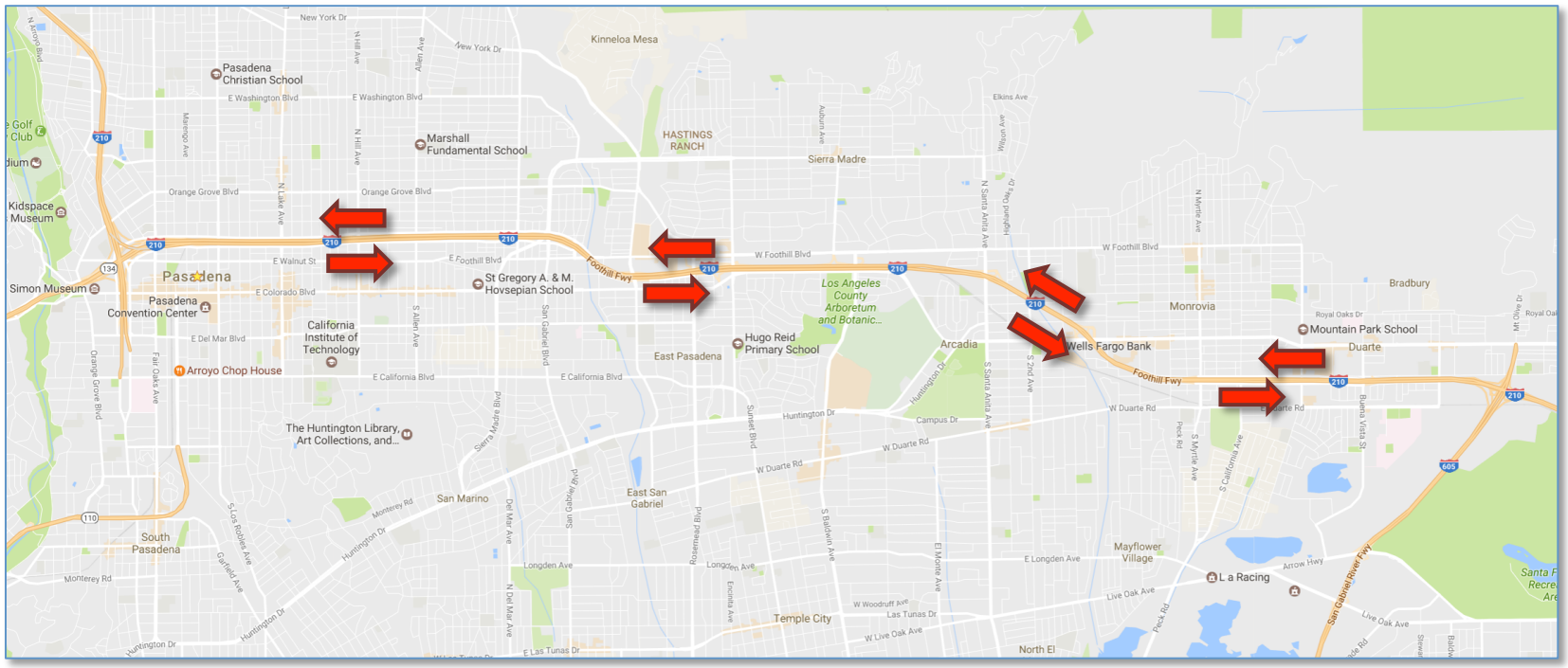
Simulation Model – Current Status

- **Example 2: Location of segments with high density (queuing)**



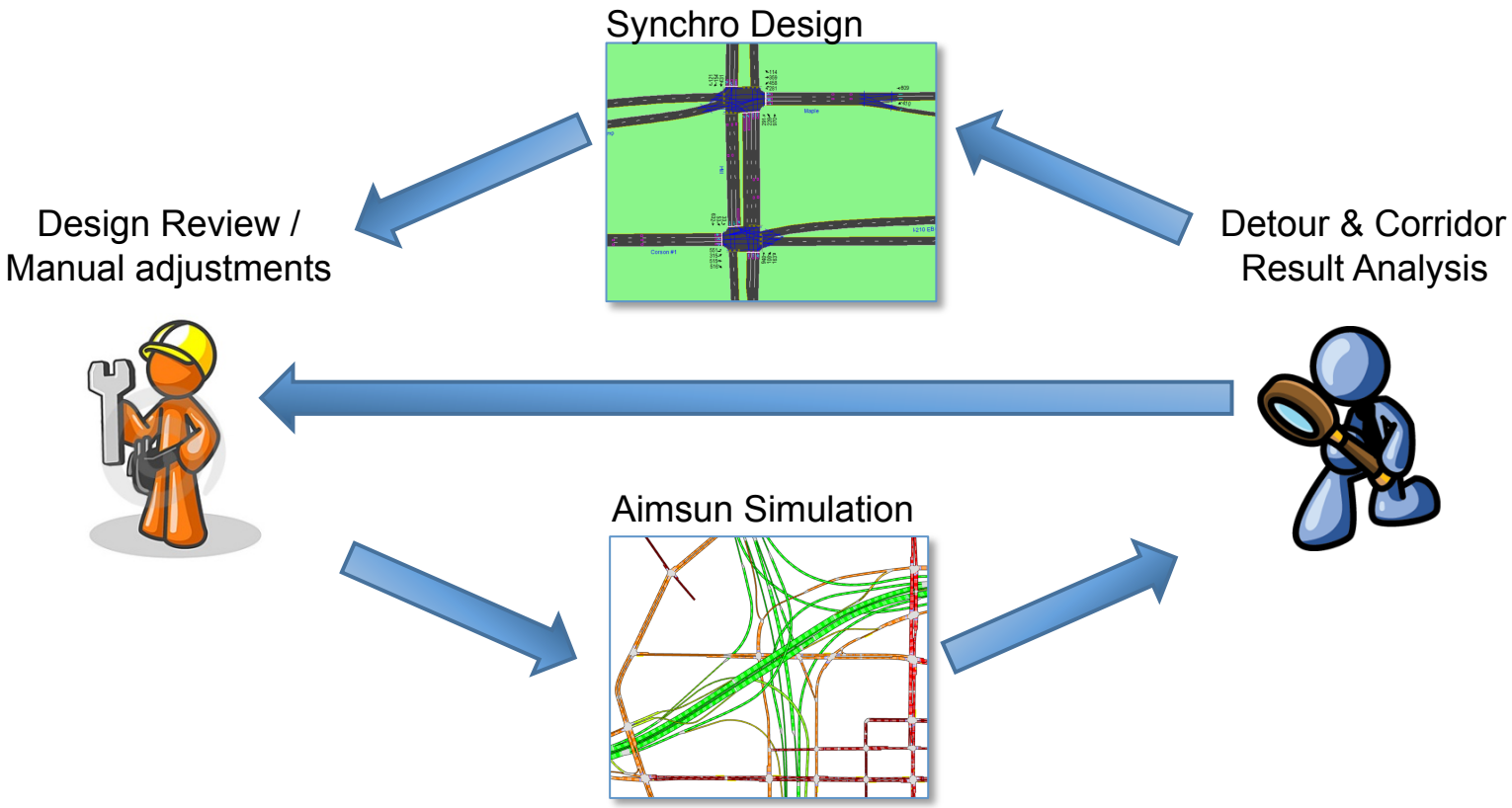
Simulation Model – Next Steps

- **Incident locations currently considered**



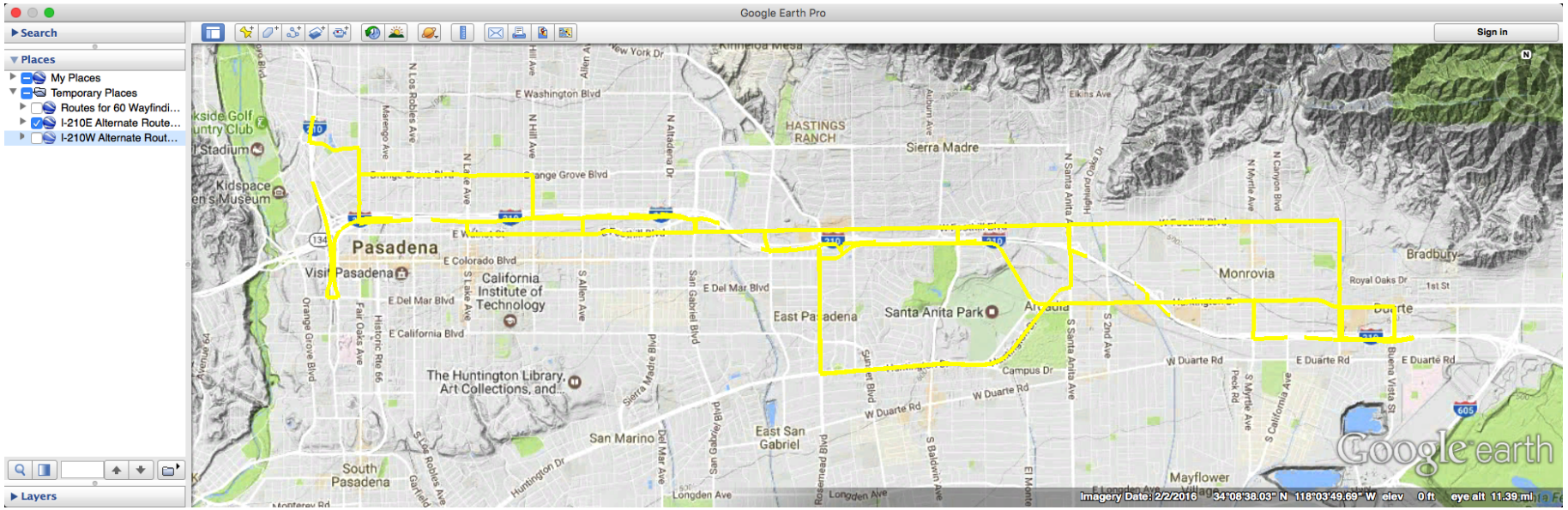
Simulation Model – Next Steps

- **Design of traffic management responses for selected incidents**

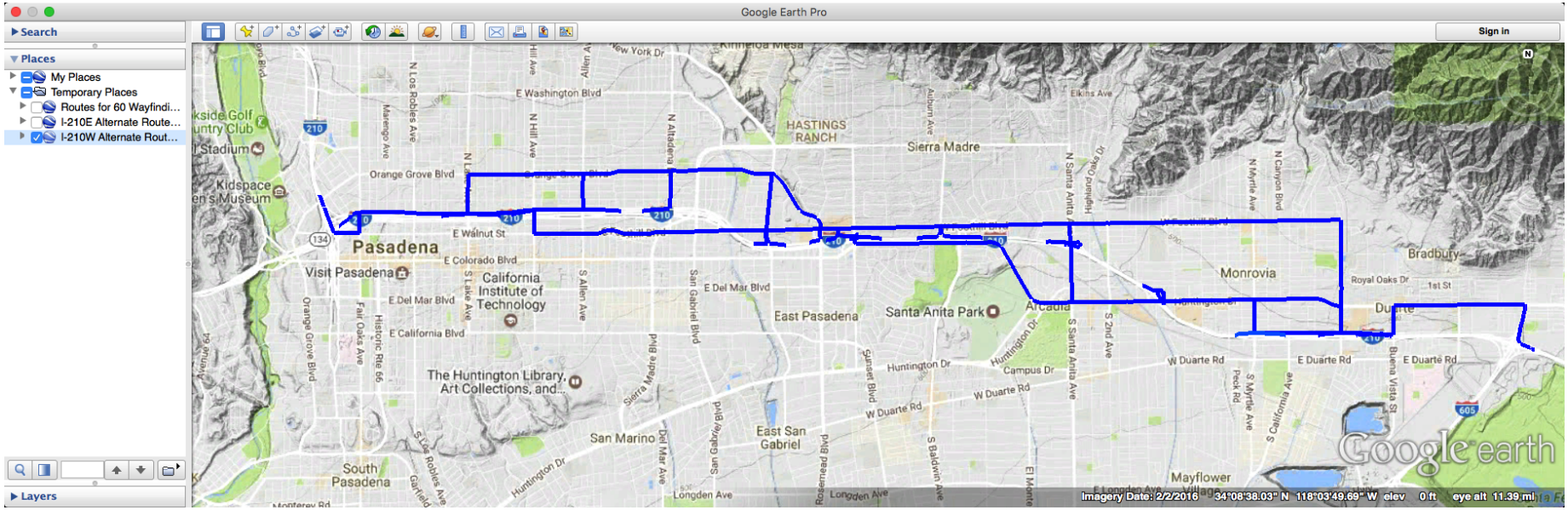


Response Plans

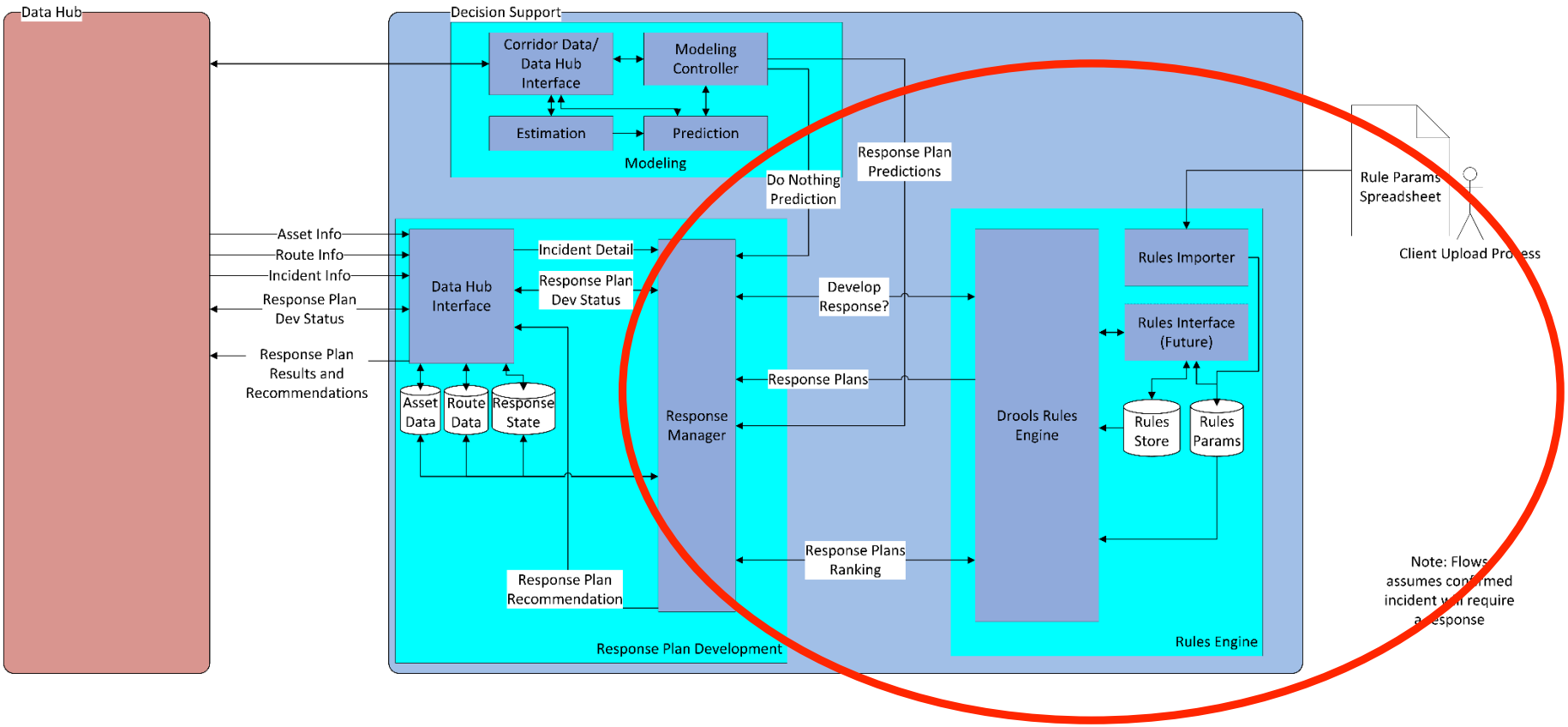
I-210 East Reroutes



I-210 West Reroutes

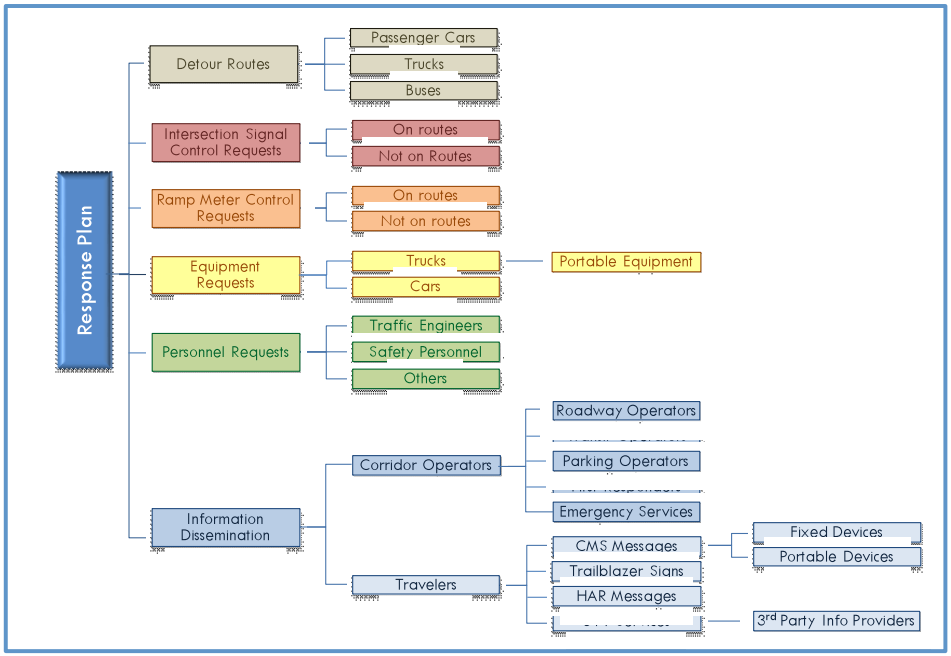


DSS – Design Detail



Anatomy of Response Plan for Model & Rules

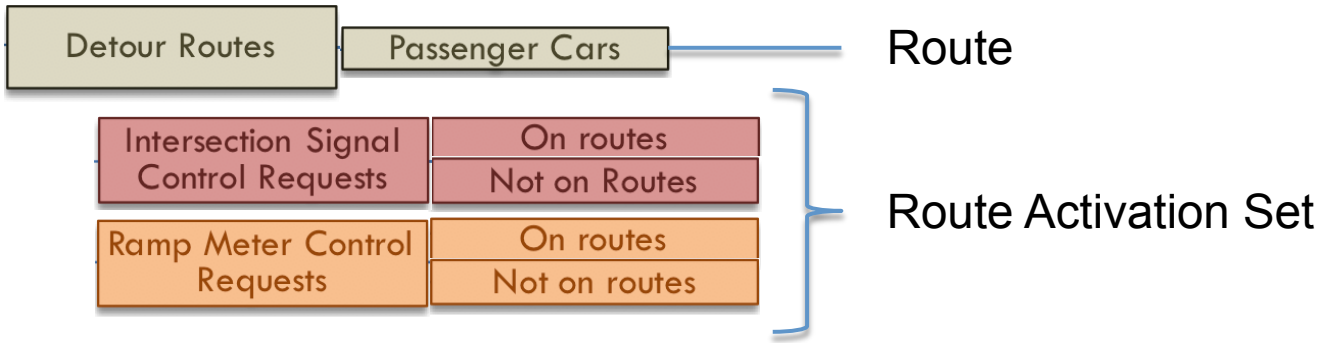
A Response Plan that's ready for implementation looks like this:



For modeling, response plan development, and rules evaluation, these elements are **managed in groups of associated items**.

Anatomy of Response Plan for Model & Rules

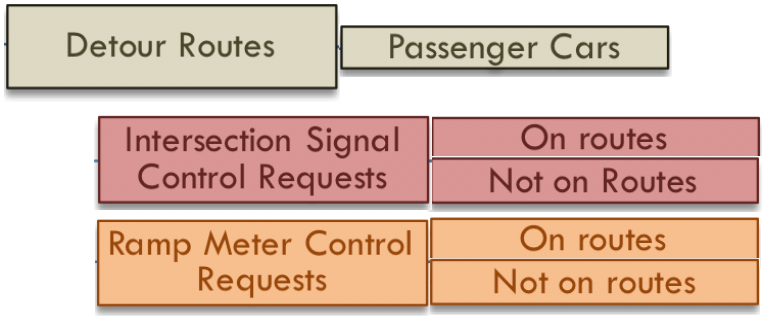
For alternate route ***modeling*** and ***plan development***, the foundation of a response plan is the route path and the timing strategies of its supporting signals (intersection & ramp).



A set of intersection & ramp timing strategies designed to work together on a given route is called a ***Route Activation Set***. There may be more than one ***Activation Set*** for each ***Route***; in practice, simpler routes might each have only one activation set.

Anatomy of Response Plan for Model & Rules

It's the AMS team that crafts these Route Activation Sets, down to the level of the specific intersection and ramp meter timing plans:



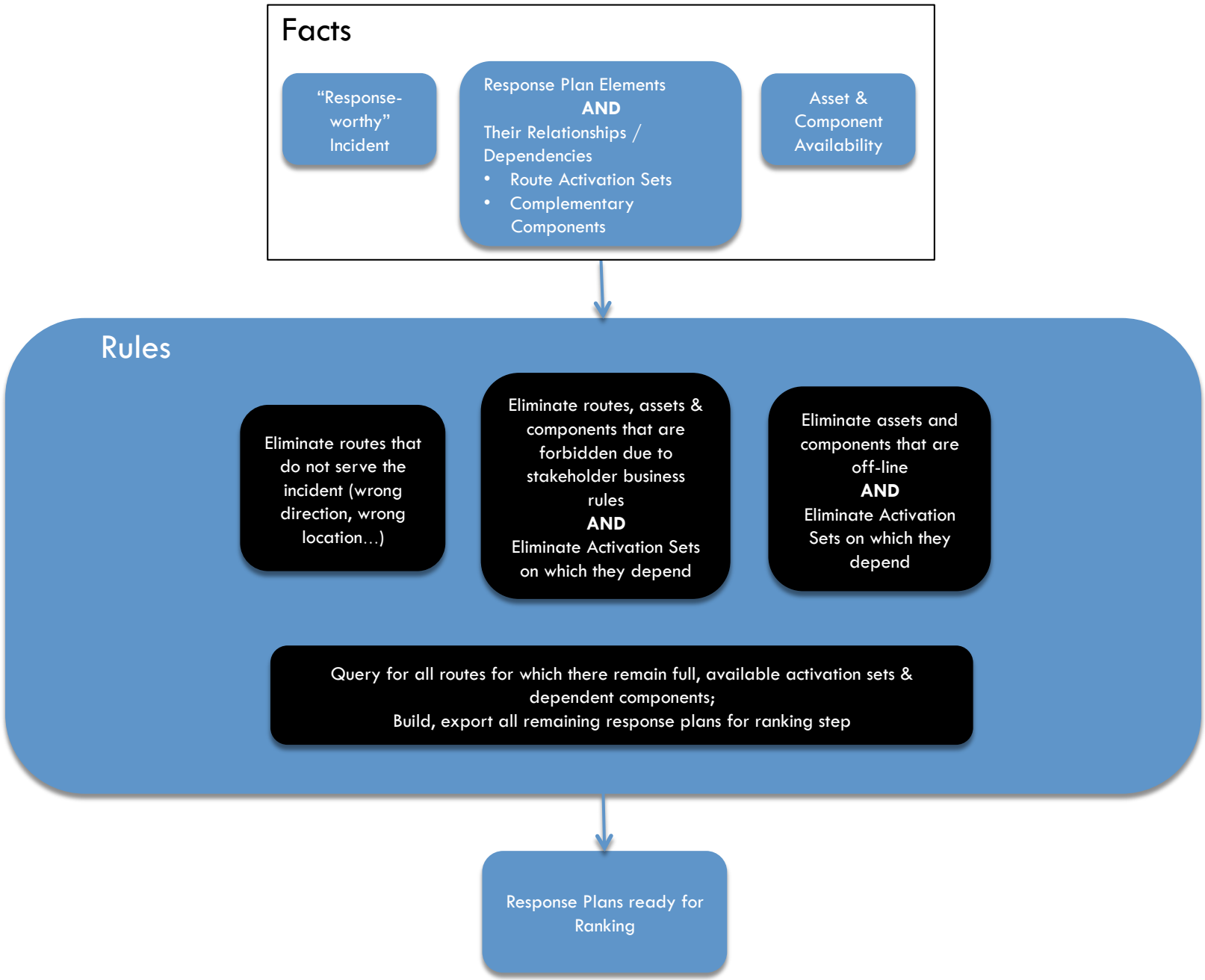
EB Corson, Lake to Allen #17		
	Intersections on route set #372	
	PA612	Plan 2
	PA173	Plan 2
	PA174	Plan 1
	PA340	Plan 2
	Intersections not on route set #93	
	PA 158	Plan 3
	PA 172	Plan 3
	Meters on route set # 115	
	EB Allen	Unmetered
	Meters not on route set #116	
	EB Hill	Unmetered
	EB Marengo	Metered

The Aimsun model is used as the evaluation tool used manually by AMS staff to build the Route Activation Sets for every route.

Response Plan Development

- **There are several main phases to rules-based plan development:**
  1. Selection of all geometrically-relevant base responses (Route+ActivationSet), given the incident
  2. Elimination due to stakeholder business rules – e.g., interferes with school operations
  3. Elimination due to asset/component (un)availability – e.g., signal comm off-line

Response Plan Development



Thank You
and
Next Meeting