Connected Corridors
Face-to-Face Meeting

Tuesday, September 17th , 2019
1:30 – 3:30 pm
Monrovia

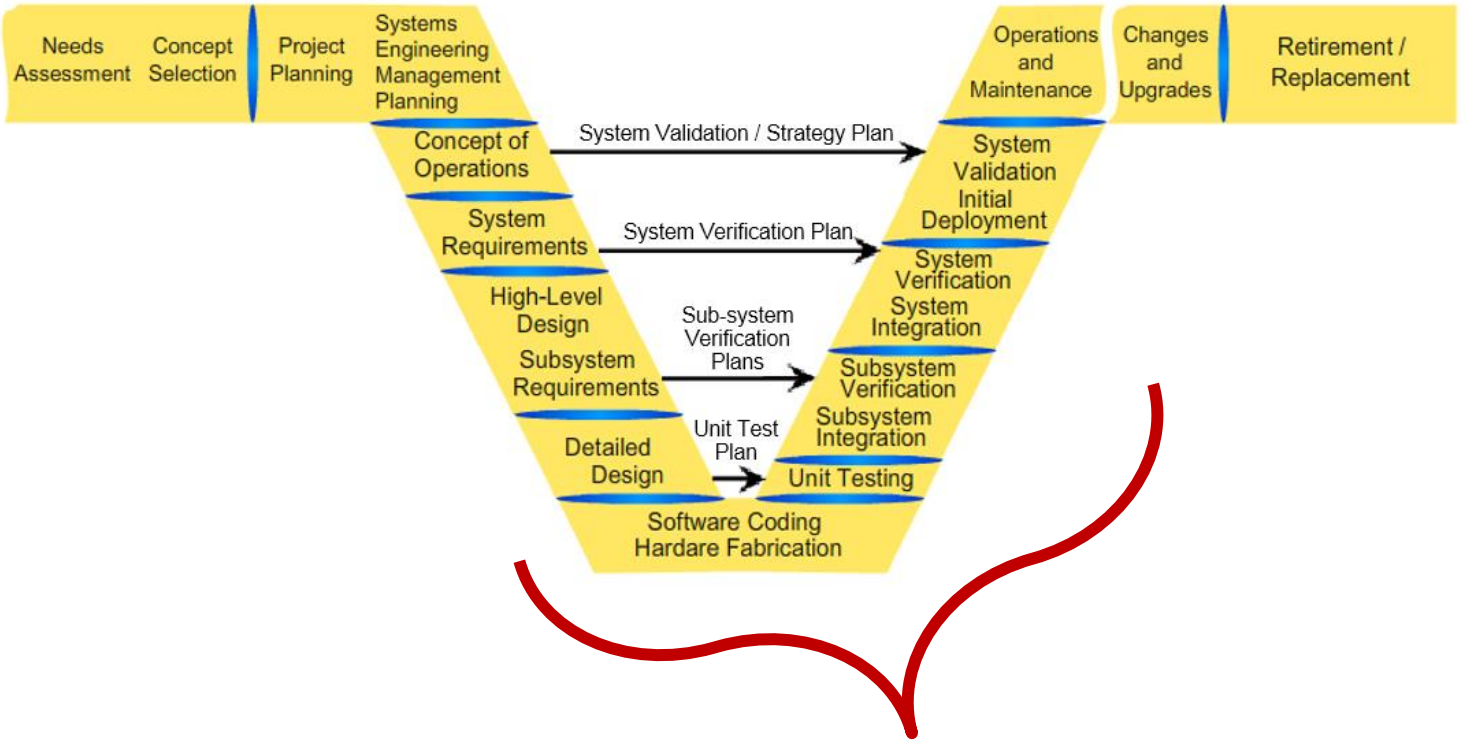
Agenda

- **1:30 - 2:00 – Program Review**
- **2:00 - 2:20 – Call for Projects Update**
- **2:20 – 2:30 – Kapsch update**
- **2:30 – 2:50 – Response Plans and Prediction**
- **2:50 – 3:00 – Closing**
  - Next Meeting at Duarte – Tuesday October 29th
  - (Monrovia, Duarte, Caltrans, County, Arcadia, Pasadena)

Schedule Discussion – System Testing

- **We anticipate system launch in the second half of next year**
  - Goal – Ready for the ITS World Congress in LA in October 2020
  - The actual full launch date is fluid due to ITS element purchase and installation
- **We anticipate system testing starting in January**
  - All initial C2C interfaces (sans McCain) completed in October
  - ATMS upgrade moved to production in October
  - Testing of ability to set plans on bench controllers in September
  - Ability to generate response plans in December based on input from ATMS
  - Kapsch initial release ready in December
  - System testing to begin in January
  - Possible live testing on selected routes where ITS elements are available in second quarter 2020

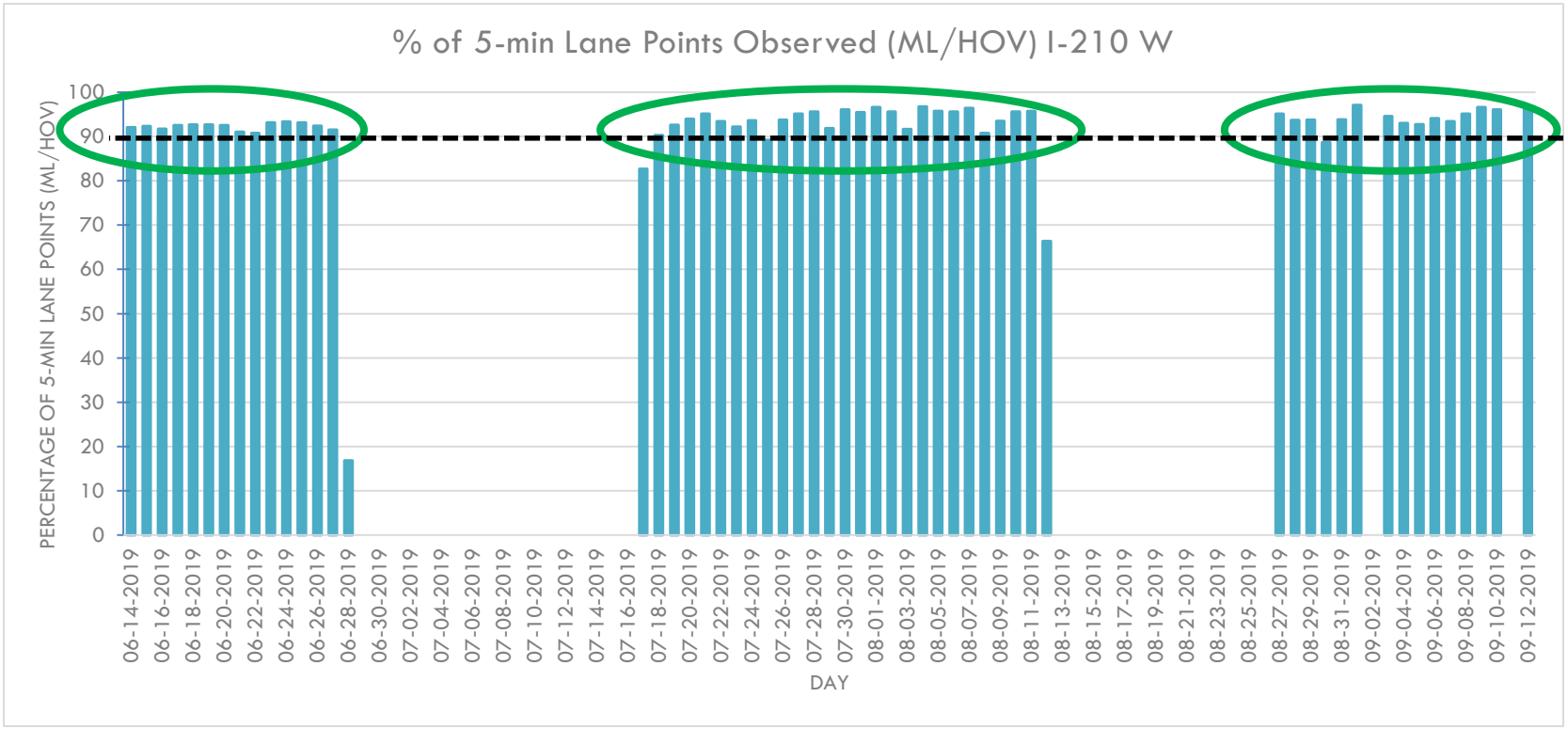
Systems Engineering Status



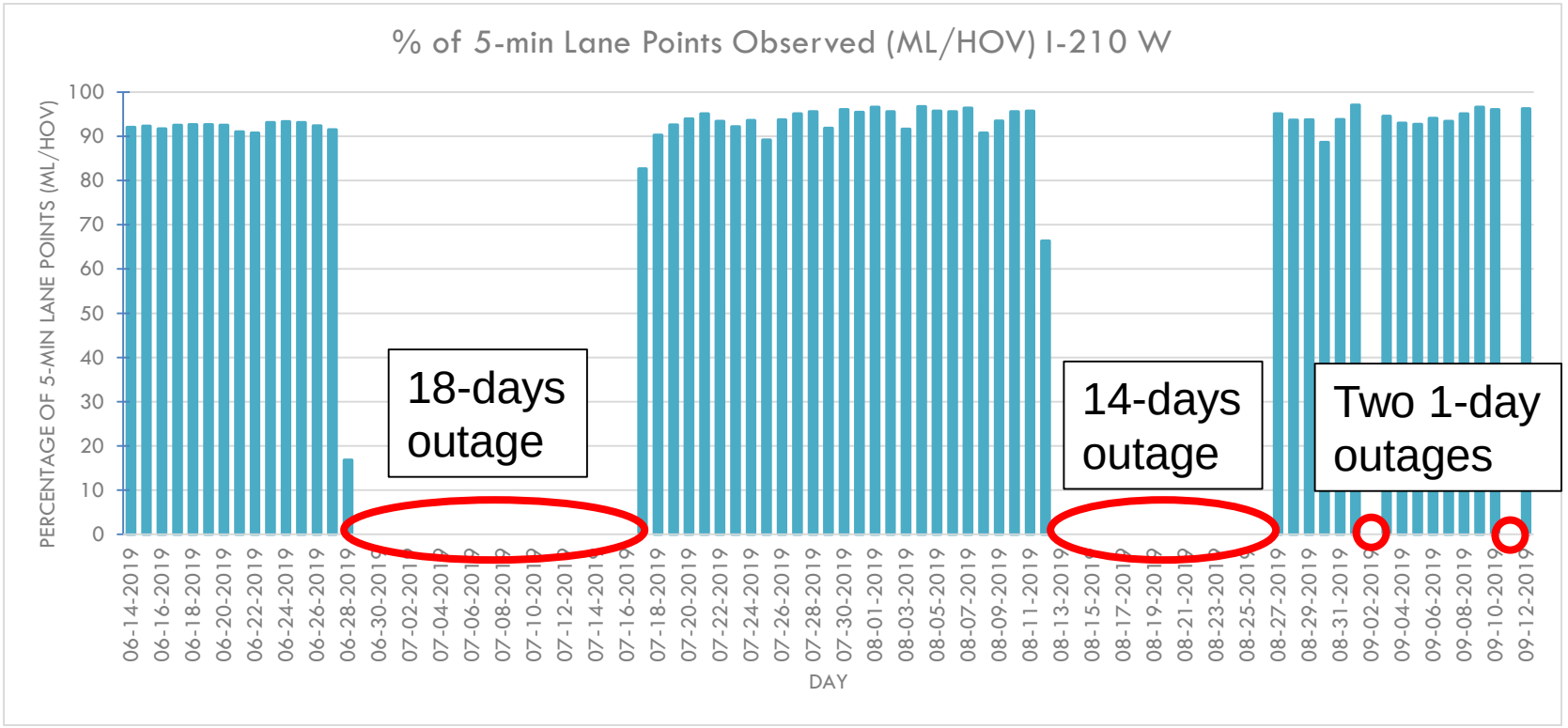
I-210 Overall Summary

I-210 – Freeway Data Quality

- **Field elements working consistently at about 95% - When working!**



I-210 – Freeway Data Quality – Data Outages



I-210 – Impacted by District 7 outages

- **District 7 outages cause severe impacts on I-210**

Caltrans (freeways) | Arcadia | Pasadena | Summary

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
	28 29 30 1 2 3 4			100.0%	92.1%	91.0%	86.7%	98.0%	91.8%
May	5 6 7 8 9 10 11			100.0%	94.7%	93.0%	86.7%	100.0%	93.5%
	12 13 14 15 16 17 18			100.0%	94.7%	93.2%	86.7%	100.0%	93.6%
	19 20 21 22 23 24 25			77.1%	72.6%	71.9%	66.7%	74.5%	71.9%
	26 27 28 29 30 31 1			100.0%	91.7%	90.4%	86.7%	98.0%	91.3%
June	2 3 4 5 6 7 8			100.0%	92.9%	91.6%	86.7%	99.0%	92.3%
	9 10 11 12 13 14 15			100.0%	94.4%	92.2%	86.7%	96.4%	92.6%
	16 17 18 19 20 21 22			100.0%	94.7%	92.1%	86.7%	96.4%	92.6%
	23 24 25 26 27 28 29			71.4%	67.7%	66.1%	61.9%	68.9%	66.3%
	30 1 2 3 4 5 6			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
July	7 8 9 10 11 12 13			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 15 16 17 18 19 20			71.4%	68.4%	65.5%	61.9%	68.4%	66.0%
	21 22 23 24 25 26 27			100.0%	97.4%	94.4%	86.7%	98.0%	94.5%
	28 29 30 31 1 2 3			100.0%	97.4%	96.1%	86.7%	100.0%	95.8%
August	4 5 6 7 8 9 10			100.0%	97.4%	96.0%	86.7%	100.0%	95.7%
	11 12 13 14 15 16 17			28.6%	27.4%	27.4%	25.7%	28.6%	27.4%
	18 19 20 21 22 23 24			0.0%	0.0%	0.0%	1.4%	0.0%	0.2%
	25 26 27 28 29 30 31			85.7%	83.5%	82.0%	74.3%	85.7%	81.9%
September	1 2 3 4 5 6 7			85.7%	83.5%	81.8%	74.3%	85.7%	81.7%

2-days outage

18-days outage

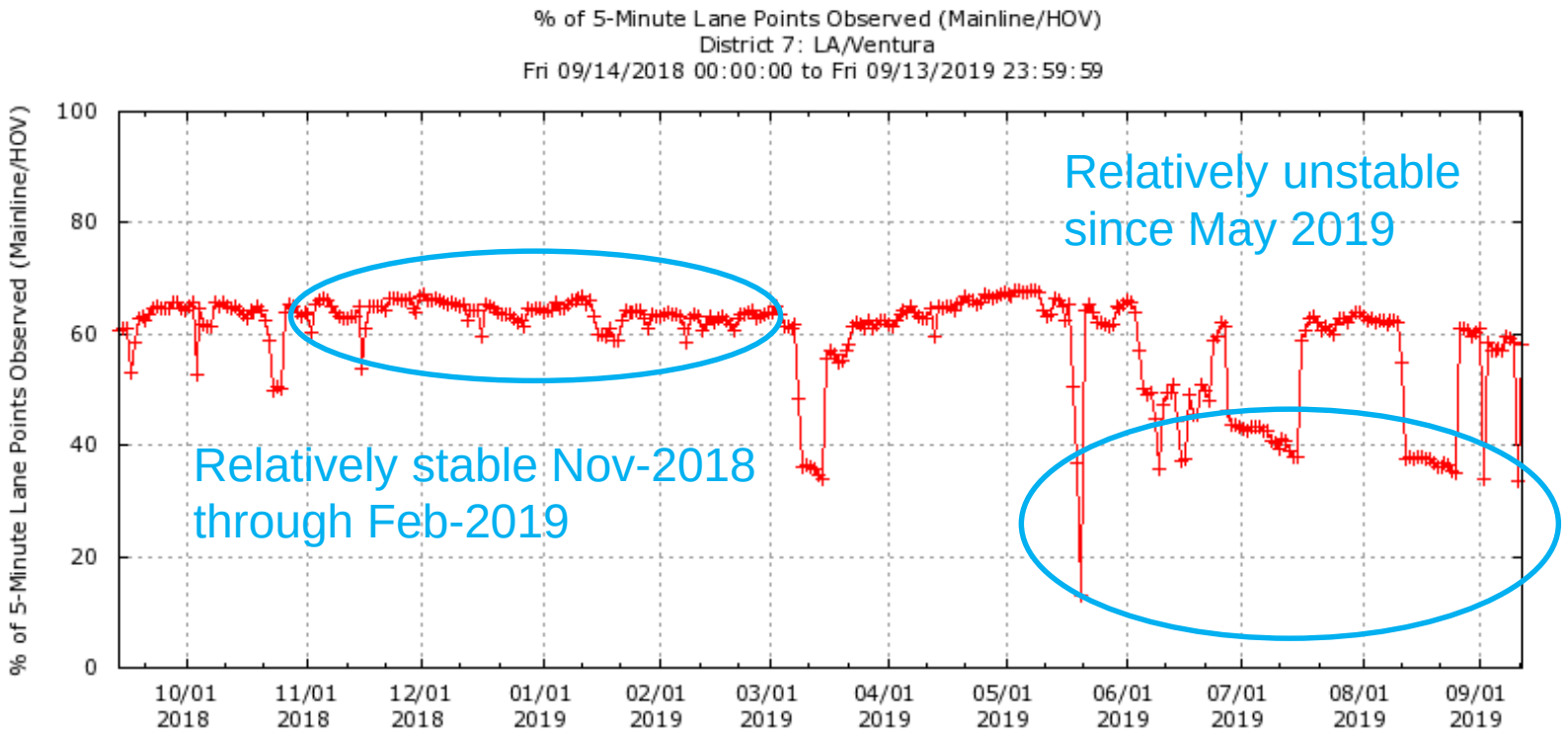
14-days outage

Two 1-day outages

EB data availability almost exactly the same as WB (shown)

District 7 as a Whole – Freeway Data Quality

- **D7 has frequent, large-scale outages starting in May 2019**



Signal Plans – Stakeholder Progress

- **Signal plan review and validation**
  - Pasadena intersections programmed with CC flush plans
    - 13 intersections along Corson and Maple
    - 10 additional signals to be programmed in the next 2 weeks
    - 23 out of 79, so we are on our way
  - LA County status
    - Next week LA County will finish the review and determine a schedule for developing the revised traffic signal timing sheets and to conduct the bench testing of the timing.
  - Arcadia status
    - Ready to begin – Need to discuss with Kevin
  - TSMSS
    - Awaiting feedback from Caltrans

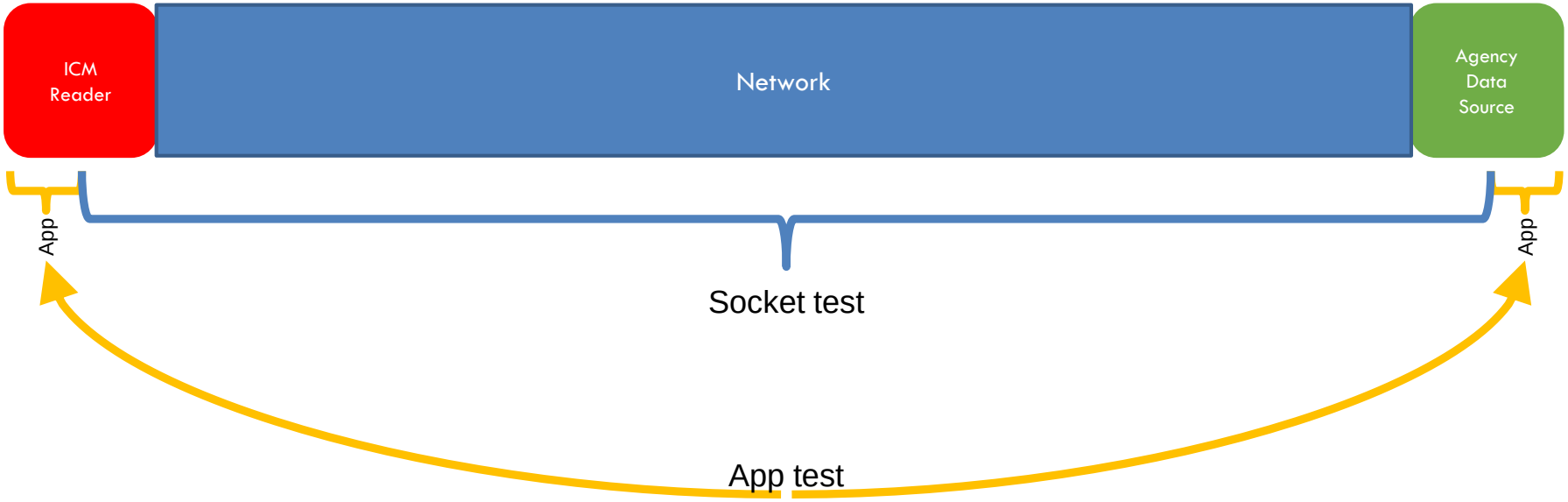
Response Plan Generation (Planning Mode)

- **Completed reviewing the response plan data model.**
- **Began coding the data model changes into the rules engine**
- **Began extracting response plans from Aimsun into rules engine**

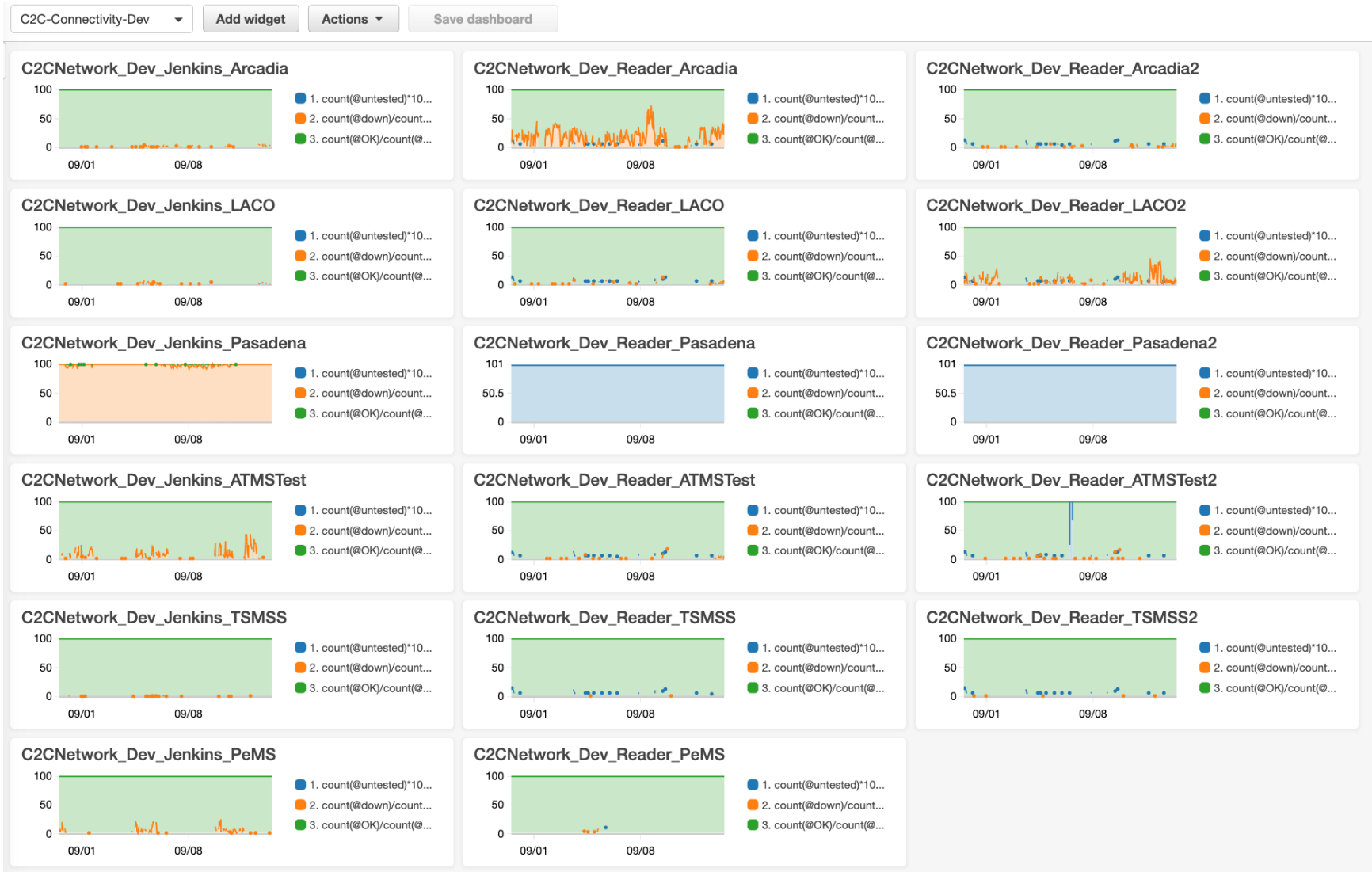
- **More on this later in the presentation**

C2C Networking

- **We created and deployed the C2C network connection monitors for the Test and Research (Integration) stacks, to complement the monitor for the Development stack.**
- **We have observed (and are investigating) the following items based on one month's worth of results from the Development stack:**
  - One of our Dev Arcadia readers experiences significant intermittent connectivity, and the other does not; likewise for the LACO pair.
  - We get occasional connections to what should be a not-yet-deployed Pasadena server.
- **We have made progress with RIITS personnel on secure user access to the ICM application via a client VPN. We are diagnosing the supporting network configuration.**


ICM Reader
Network
Agency Data Source
App
App
Socket test
App test

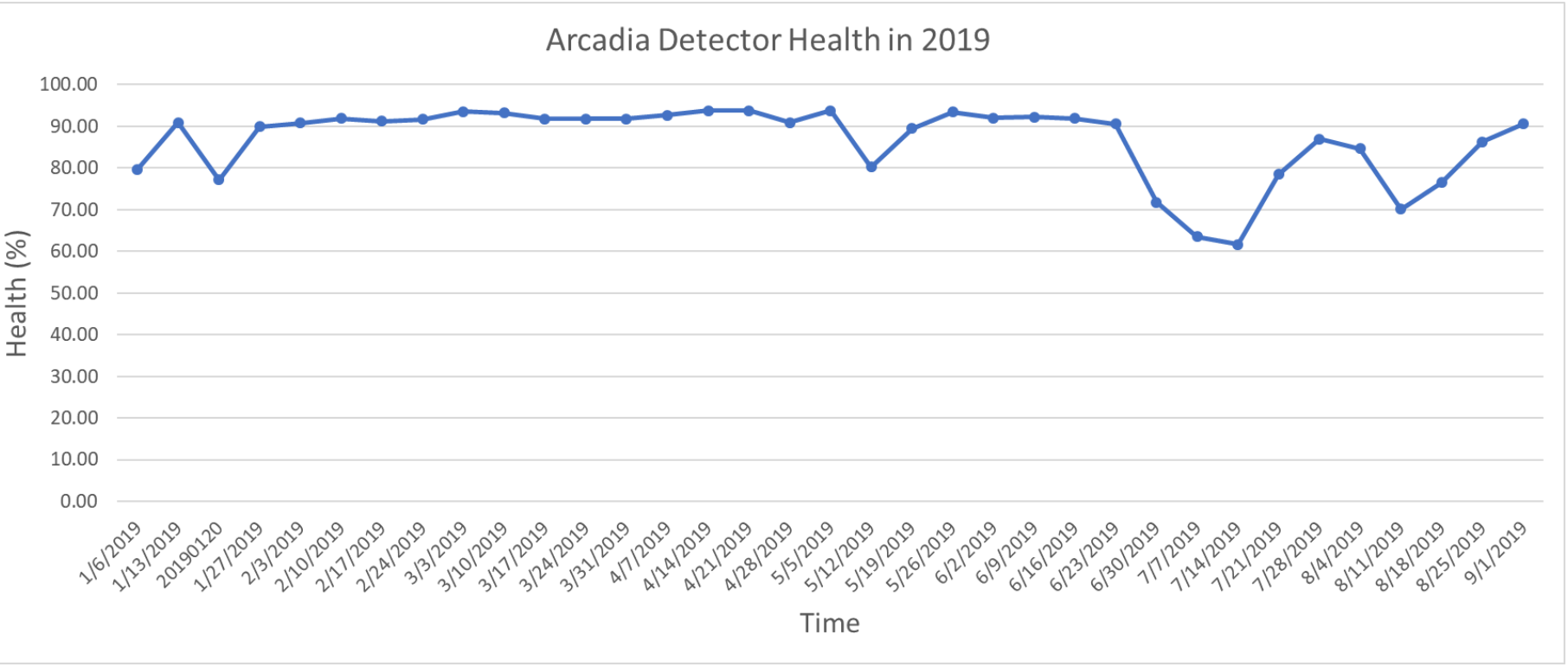
Dev/C2C Connectivity, 28-Day Summary



Arterial Summary

- **Data management**
  - Arcadia's TCS server and the IEN
    - Collect, process and generate a weekly data report
    - Due to configuration changes in Arcadia, we extracted a new set of historical flow-occupancy profiles for the detectors in Arcadia using data retrieved in Year 2019.
  - Data Hub
    - Retrieve TMDD Inventory and Status messages 24/7
    - Enabled a function that runs 24/7 to detect Inventory Changes for arterial detectors.
- **Data quality analysis on TMDD messages**
  - LA County
    - We discussed with KH the Data Quality Report of LACO TMDD.
    - Document generated describing how to convert coordination tables in a timing sheet into TMDD messages of Intersection Signal Control Schedule. Provided to KH
- **System requirements for traffic estimation in the DSS**
  - Developed detailed system requirements for traffic estimation data interfaces.
  - Completed the document "Data Interface Requirements for Traffic Estimation"

Detector health report in Arcadia

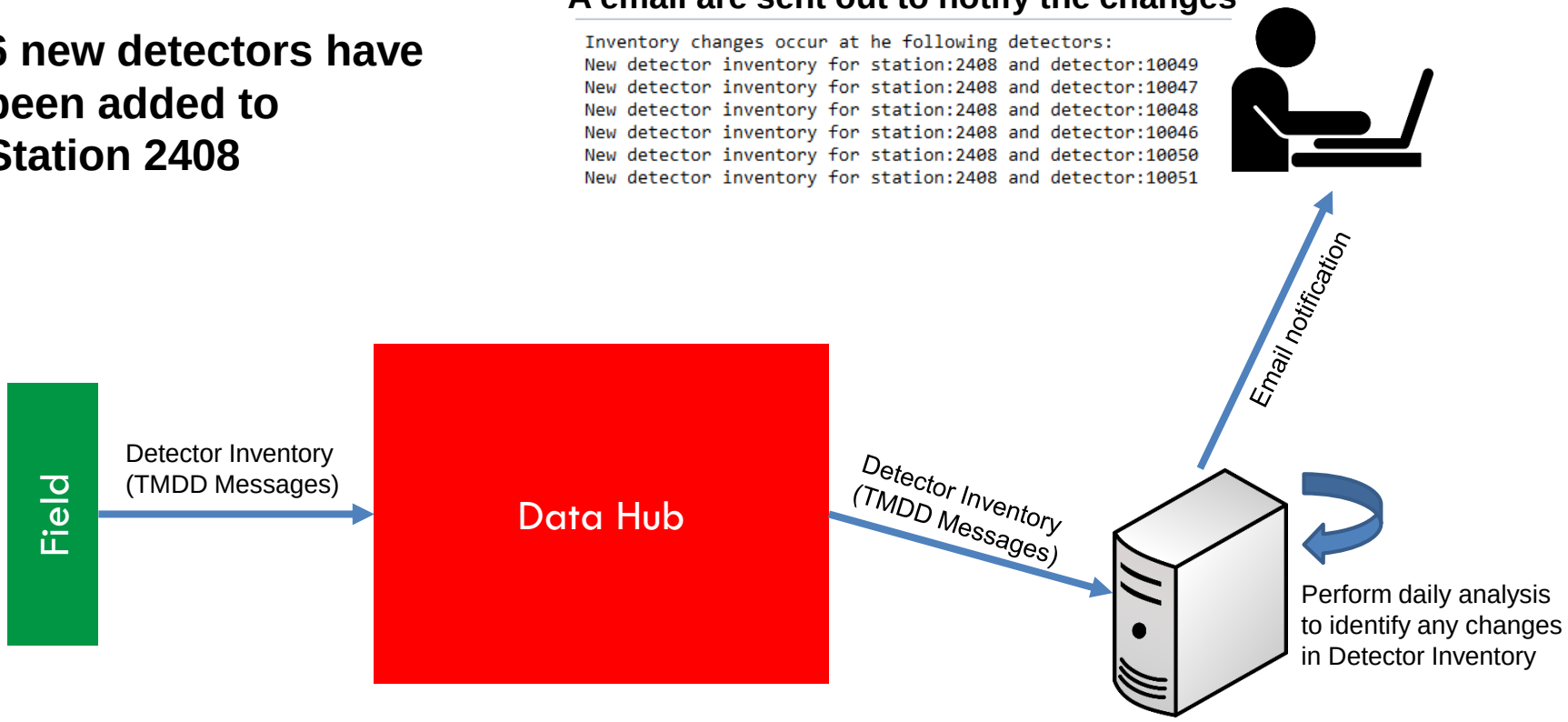


Daily Detection of ITS Inventory Changes

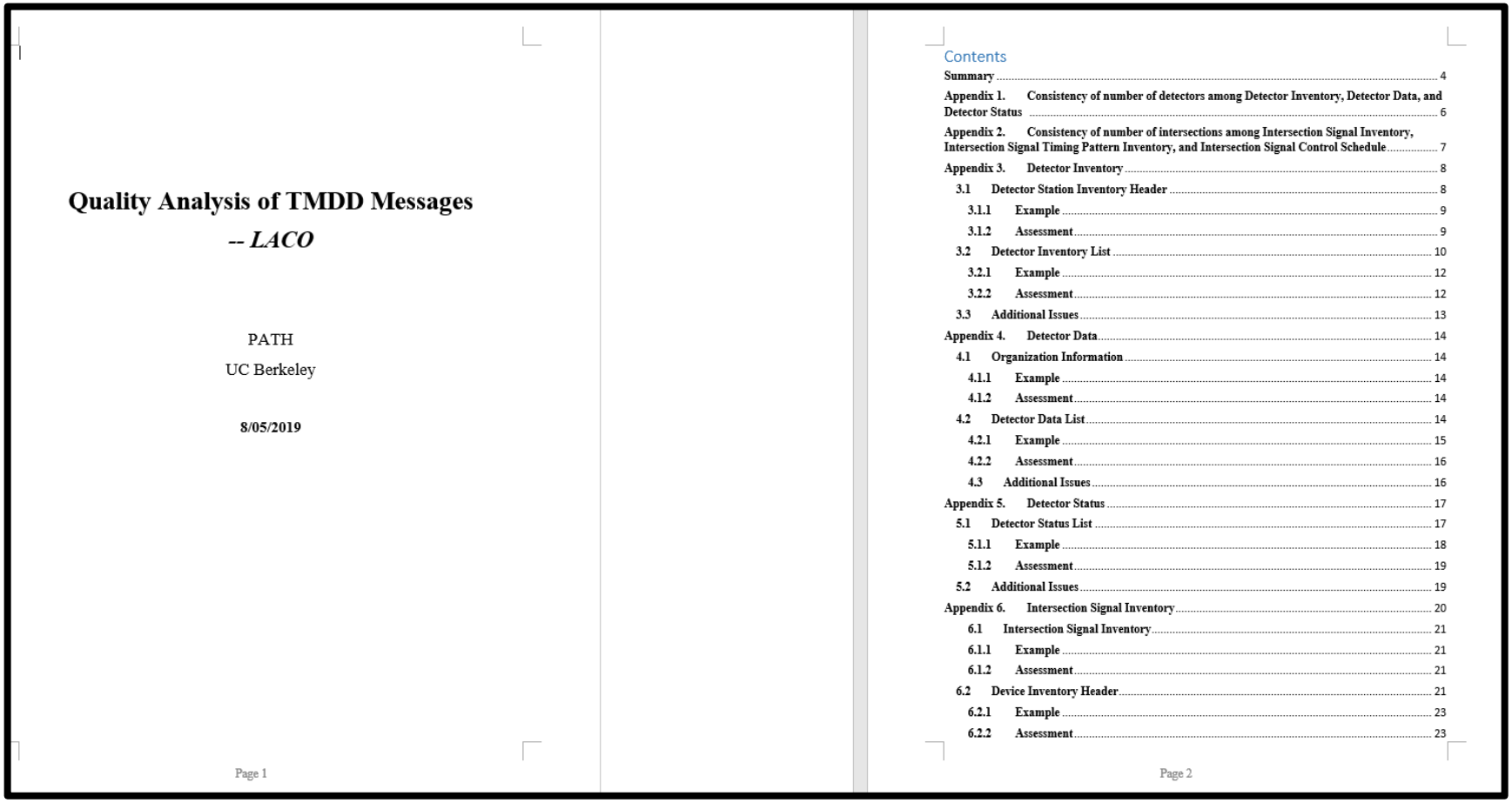
6 new detectors have been added to Station 2408

A email are sent out to notify the changes

```
Inventory changes occur at he following detectors:
New detector inventory for station:2408 and detector:10049
New detector inventory for station:2408 and detector:10047
New detector inventory for station:2408 and detector:10048
New detector inventory for station:2408 and detector:10046
New detector inventory for station:2408 and detector:10050
New detector inventory for station:2408 and detector:10051
```



Data quality report for LACO (Data Hub)



Quality Analysis of TMDD Messages

-- LACO

PATH

UC Berkeley

8/05/2019

Page 1

Contents

Page 2

Document on converting coordination tables into TMDD messages

An Instruction to Convert Coordination Tables into TMDD Messages

PATH

410 McLaughlin Hall, MC 1720
Berkeley, CA 94720
United States

1. Summary

In this document, we aim to provide instructions on how to convert coordination tables in a timing sheet into TMDD messages of *Intersection Signal Control Schedule*. In Section 2, we provide an example of actual coordination tables at the intersection, Rosemead Bl@Del Mar Bl (ID 3374). These tables include: (i) Time Of Day (TOD) tables, and (ii) Holiday tables (Floating Holidays and Exception Days). In Section 3, we provide detailed descriptions of the TMDD Data Frame *Intersection Signal Control Schedule*, which is also available in the *Connected Corridor System Interface Design Specification* document. In Section 4, depending on how to handle Floating Holidays and Exception Days, we provide two different approaches to construct the TMDD messages. More detailed description is provided in the rest of the document.

2. Example: Coordination Tables for Rosemead Bl @ Del Mar Bl (ID:3374)

2.1 Time of Day Tables

TABLE 0 - Time Of Day

Event	Hour : Min	Plan or Function	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	00 : 00	E	X	X	X	X	X	X	X
1	06 : 00	2		X	X	X	X	X	
2	09 : 00	1	X	X	X	X	X	X	X
3	15 : 30	3		X	X	X	X	X	
4	19 : 00	1		X	X	X	X	X	
5	22 : 00	E	X	X	X	X	X	X	X
6	:								
7	:								
8	:								
9	:								
A	:								
B	:								
C	:								
D	:								
E	:								
F	:								

TABLE 1 - Time Of Day

Event	Hour : Min	Plan or Function	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	00 : 00	E		X	X	X	X	X	
1	09 : 00	1		X	X	X	X	X	
2	22 : 00	E		X	X	X	X	X	
3	:								
4	:								
5	:								
6	:								
7	:								
8	:								
9	:								
A	:								
B	:								
C	:								
D	:								
E	:								
F	:								

2.2 Holiday Tables

TABLE 6 - Floating Holidays

Event	Month / Day	Table	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	01 / 03	1		X					
1	02 / 03	1		X					
2	05 / 09	1		X					
3	09 / 01	1		X					
4	11 / 04	1					X		
5	/								
6	/								
7	/								
8	/								
9	/								
A	/								
B	/								
C	/								
D	/								
E	/								
F	/								

TABLE 7 - Exception Days

Event	Month / Day	Table	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	01 / 01	1		X	X	X	X	X	
1	01 / 02	1		X					
2	07 / 04	1		X	X	X	X	X	
3	09 / 05	1		X					
4	11 / 10	1						X	
5	11 / 11	1		X	X	X	X	X	
6	11 / 12	1		X					
7	12 / 24	1		X	X	X	X	X	
8	12 / 25	1		X	X	X	X	X	
9	12 / 26	1		X				X	
A	/								
B	/								
C	/								
D	/								
E	/								
F	/								

Data interfaces for traffic estimation

Data Interface Requirements for Traffic Estimation

Qijian Gan

qgan@berkeley.edu

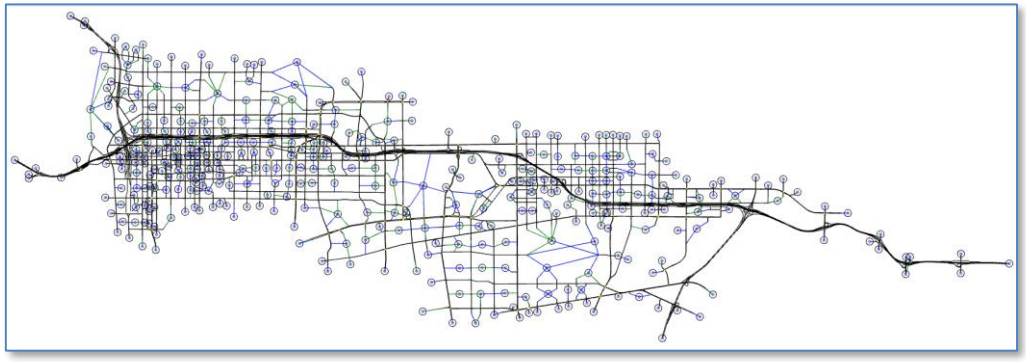
PATH

410 McLaughlin Hall, MC 1720
Berkeley, CA 94720
United States

(Version 4.0)

Aimsun Model

- **Some statistics:**
  - 2579 signal control plans
  - 7312 detectors
  - Over 1000 lane miles of roadway
  - 4242 road sections
  - 1748 nodes
  - 395 trip origin / destination nodes



Aimsun Model Updates

- **Input data**
  - Updated some of the PeMS detector data used for calibration reference to reflect maintenance activities on detectors over the past 6 months
  - Received a first set of average flow rates extracted from the detectors linked to Arcardia's TransSuite system
- **Detector mapping**
  - Updated the mapping of detectors in Arcadia to match the current setup observed in the TransSuite system
- **Traffic signals**
  - Updated timing parameters along Maple and Corson to match updated timing sheets received from Pasadena

Aimsun Model Updates

- **Ramp metering**
  - Updated the control parameters of several ramp meters to match new timing sheets received from Caltrans (many with changes since November).
  - Changed how the Ramp Metering API read flow rates (from veh/hr instead of veh/min or veh/3 min)
- **Driver response to incidents**
  - Tweaked various triggers used to simulate driver response to unusual queueing along the freeway and detour arterials
- **Demand modeling**
  - Some tweaks in the modeling of the weekday, Saturday, and Sunday traffic demands

Response Plan Development

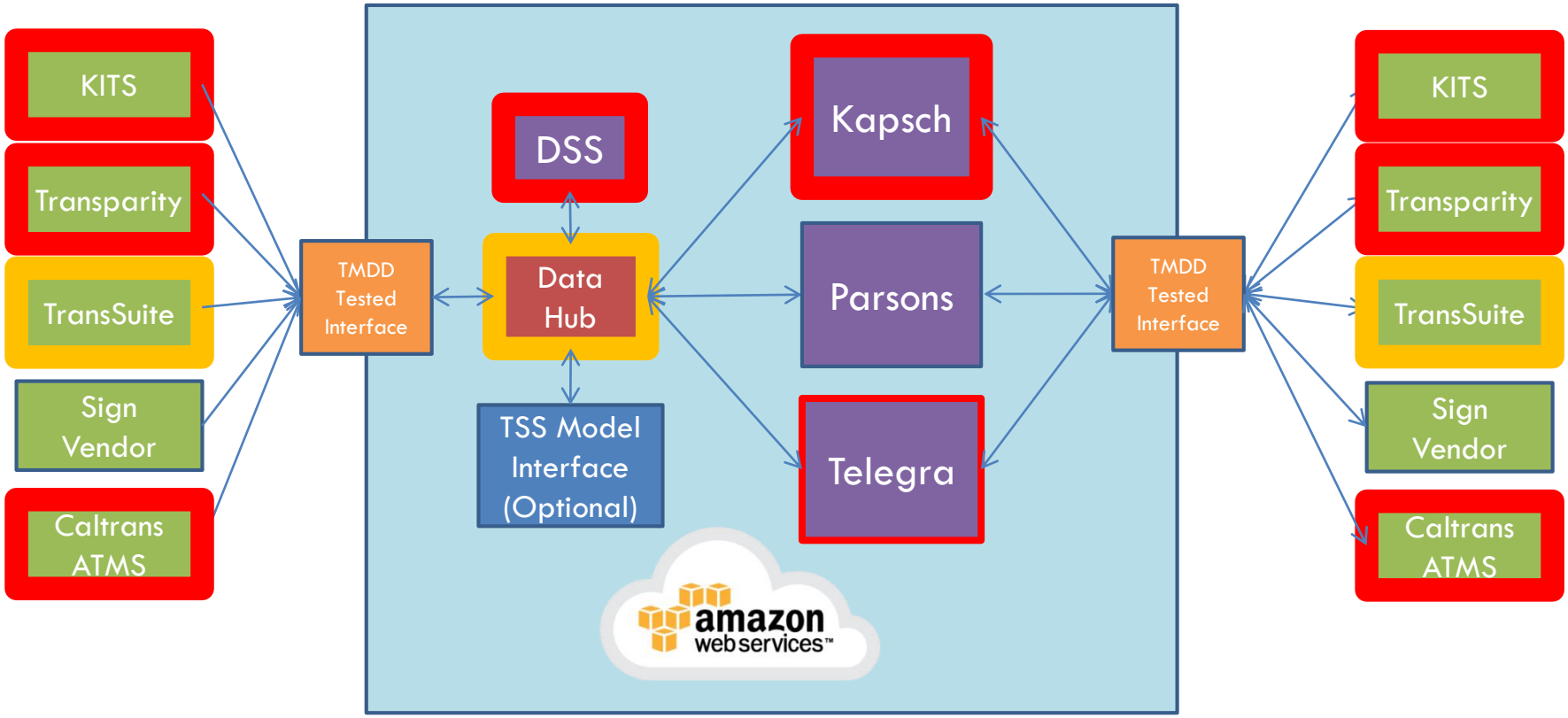
- **Incident information**
  - Entered 4 incidents into the ATMS system to obtain the incident information for use in testing
- **Input data processing**
  - Completed a program to extract incident information, selected detours, requested ramp metering, and requested signal control changes from response plane messages
- **Metrics to evaluate response plans**
  - Continued analyzing the metrics produced by various incidents to assess their potential impacts and usefulness on decision-making

Ramp Metering Information

- **Waiting on updated information on ramp meters for the following freeway sections** *(Information at PATH for these generally date back to 2007-2009)*

  - I-210 Extension EB
    - Lincoln
    - Mountain
  - I-210 EB
    - Vernon
    - Azusa SB
    - Azusa NB
    - Citrus SB
    - Citrus NB
  - I-210 WB
    - Citrus
    - Azusa NB
    - Azusa SB
    - Vernon
    - I-605 Connector
    - Mountain
    - Santa Anita SB
    - Rosemead-Foothill
    - Rosemead SB
    - Walnut
    - Mountain
    - Lincoln
  - SR-134 EB
    - Orange Grove
    - San Rafael
    - Figueroa
    - Colorado
  - SR-134 WB
    - Fair Oaks
    - Orange Grove
    - San Rafael

C2C Interface Implementations - Status



Systems Development and Integration

- **Priorities**
  - Improve system funtionality
    - Completed workflow processing improvements for data pipelines, incident management). Currently in test.
    - Exposed control of data pipelines (including start and stop commands) to Corridor Management System.
    - Completed implementation of internal cloud DNS services.
  - Improve release frequency – goal is new release to test every 2 days
    - Designing containerization strategy and use of AWS Elastic Container Service. Will improve developer speed, release quality, and system failure recovery time and resilience.
    - Decreased common dependencies in system components to allow breakup of deployments into smaller, independent elements. Will continue this effort.
    - Improved integration testing in dev environment to increase release quality.

Systems Integration

- **Pasadena**
  - Detailed design comments provided.
  - Updated documents provided to us:
    - Caltrans I210 C2C McCain TMDD HLD (High Level Design) – Final
    - Caltrans I210 C2C McCain TMDD SDD (Detailed Design) – Final (comments addressed)
    - Caltrans I210 C2C McCain TMDD Function Bench Testing (Verification Plan)
  - Awaiting testing endpoint
- **LA County**
  - Data quality report provided to Kimley Horn.
  - Began bench testing of setting and terminating signal plans yesterday
    - This morning we did a successful signal change request and verified it transitioned to a new plan
    - We hope to test the termination request later today.

Systems Integration

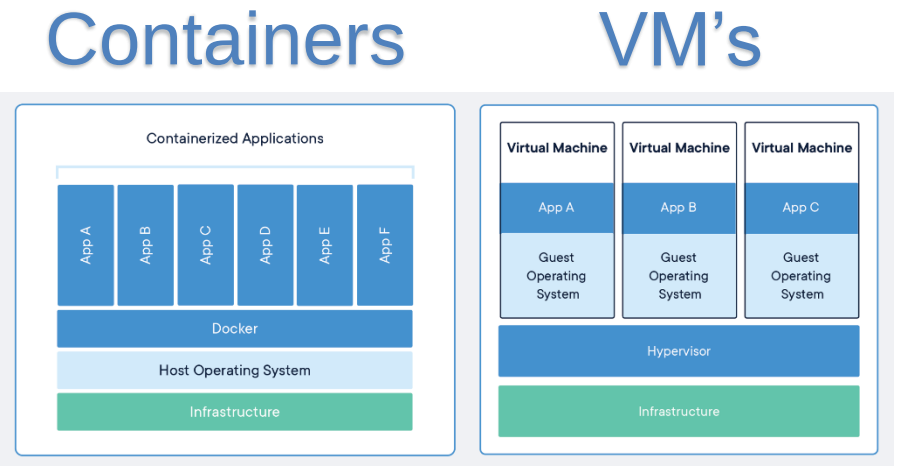
- **Arcadia**
  - Awaiting signal plan termination information from Transcore
  - Will then do bench testing of setting/terminating a signal
- **TSMSS**
  - Awaiting entry of sensor information into TSMSS
- **ATMS**
  - Continuing testing of changes to accommodate arterial incidents. Have identified some issues that have been corrected so testing can continue.
  - Important that we get at least a portion of the new ATMS functions migrated to production
  - Meeting with Caltrans, Parsons and PATH scheduled for Oct 4th
- **Corridor Management System**
  - Provided draft of minor changes to data interfaces for review by Kapsch

Containerization Objectives

- **Packaging in container assures application behavior remains the same regardless of where deployed**
  - Dev/test/integration/production
  - Local developer environment vs. cloud
  - Across CT Districts and Corridors
- **Simplifies service configuration**
- **Version container images – manage full package (OS/Dependencies/ Operating System), not just the application**
- **Better quality deployments, better quality code, reduce "infrastructure as code" complexity**
- **Faster deployments**
- **Faster recovery upon failure – containers are much smaller, take much less time to start (seconds vs minutes)**

What are Containers?

- **Self contained package of operating system, application, dependencies, and configuration. Everything is packaged together at the time of the software build process.**
- **Can be deployed anywhere and will operate the same regardless of where they are deployed**
- **Different from virtual machines**
  - VMs abstract infrastructure
  - Containers abstract applications
  - Much smaller footprint than VM's
  - Much smaller startup time than VM's



AWS Elastic Container Service

- **We will use AWS Elastic Container Service**
  - Integrated service orchestration for containers
  - Benefits of using ECS and containers:
    - Easier deployment automation – especially easier to maintain
    - Autoscaling – more computing power when load increases, automated recovery upon failure
    - Load balancing – efficient use of computing resources, reduced cost
    - Security integration – use security already built
    - Simplified networking – maintain existing networking infrastructure
    - Monitoring

I-210 Connected Corridors
Face-to-Face Meeting

City of Monrovia,
Community Center, 119 W. Palm Avenue, Monrovia, CA 91016
Tuesday, September 17, 2019
1:30 – 3:30 pm

Agenda

- I-210 CC Arterial Systems Improvement Project System Consulting Services – Scope
- Expected Timeline
- Status of 9 procurement package
- Next Steps

I-210 CONNECTED CORRIDORS ARTERIAL SYSTEMS IMPROVEMENT PROJECT SYSTEM CONSULTING SERVICES

SCOPE OF WORK

Sep.17, 2019

Project Objective

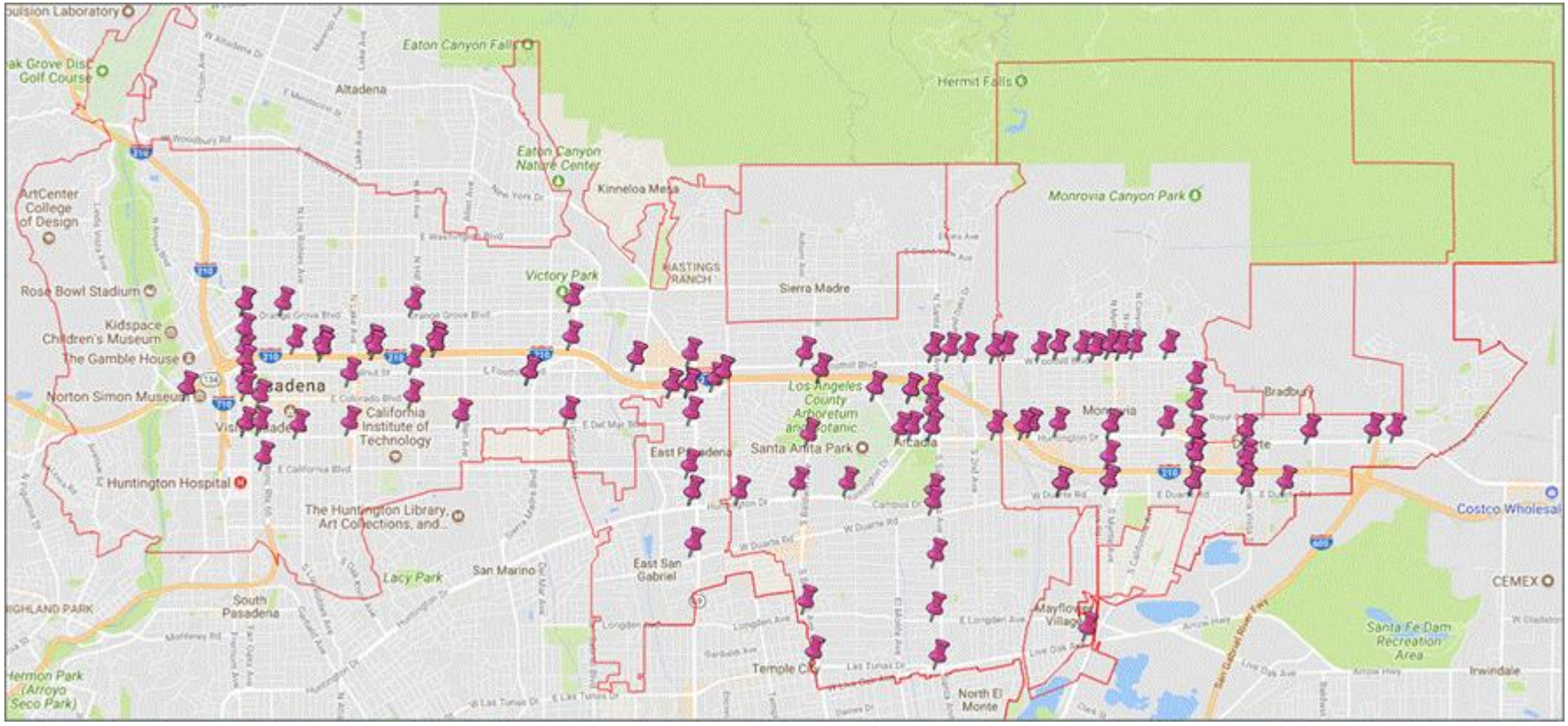
- Assist Caltrans D7 to manage the execution of the 9 arterial ITS improvement projects

#	Package Description	Contract #	Contract Status
1	Bluetooth – Iteris Velocity	07A4470	Completed
2	Bluetooth – BlueToad	07A4477	Awarded, in Progress
3	New Controller Cabinets	07A4603	Under DPAC Review
4	Communication Upgrades	07A4479	Awarded, in Progress
5	Firmware/Timing Plan Updates/Controller Upgrades	07A4480	Awarded, in Progress
6	Video Detection System	07A4481	Awarded, in Progress
7	Data Communication Module and Video Detection Software Upgrade	07A4601	Under DPAC Review
8	Advanced Traveler Information Systems	N/A	DMS – Under DPAC Review Integration - Under DPAC Review Static Signs – Caltrans, in Progress
9	Environmental Stations with Air Quality Sensors and Open Data Systems	07A4388	Awarded, in Progress

Project Area

#	Package Description	Contract #	Metro & Caltrans	City of Pasadena	City of Arcadia	City of Monrovia	City of Duarte	LA County
1	Bluetooth – Iteris Velocity	07A4470	√		√			
2	Bluetooth – BlueToad	07A4477	√	√		√	√	√
3	New Controller Cabinets	07A4603	√	√	√			
4	Communication Upgrades	07A4479	√		√	√	√	√
5	Firmware/Timing Plan Updates/Controller Upgrades	07A4480	√	√	√	√		√
6	Video Detection System	07A4481	√	√	√	√	√	√
7	Data Communication Module and Video Detection Software Upgrade	07A4601	√	√	√	√	√	√
8	Advanced Traveler Information Systems	N/A	√	√	√	√	√	√
9	Environmental Stations with Air Quality Sensors and Open Data Systems (ODS)	07A4388	√					

Project Area (cont.)

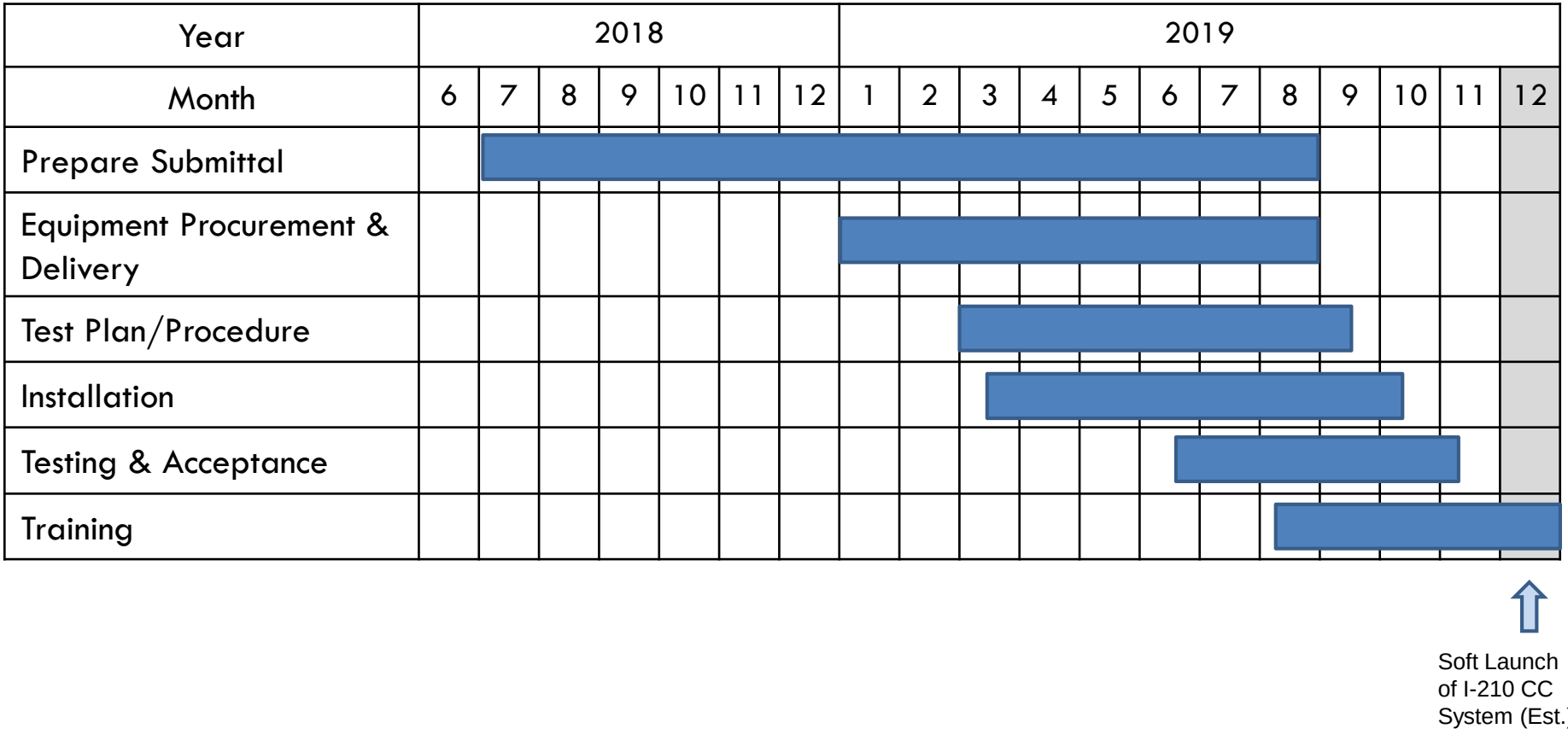


UPDATE ON

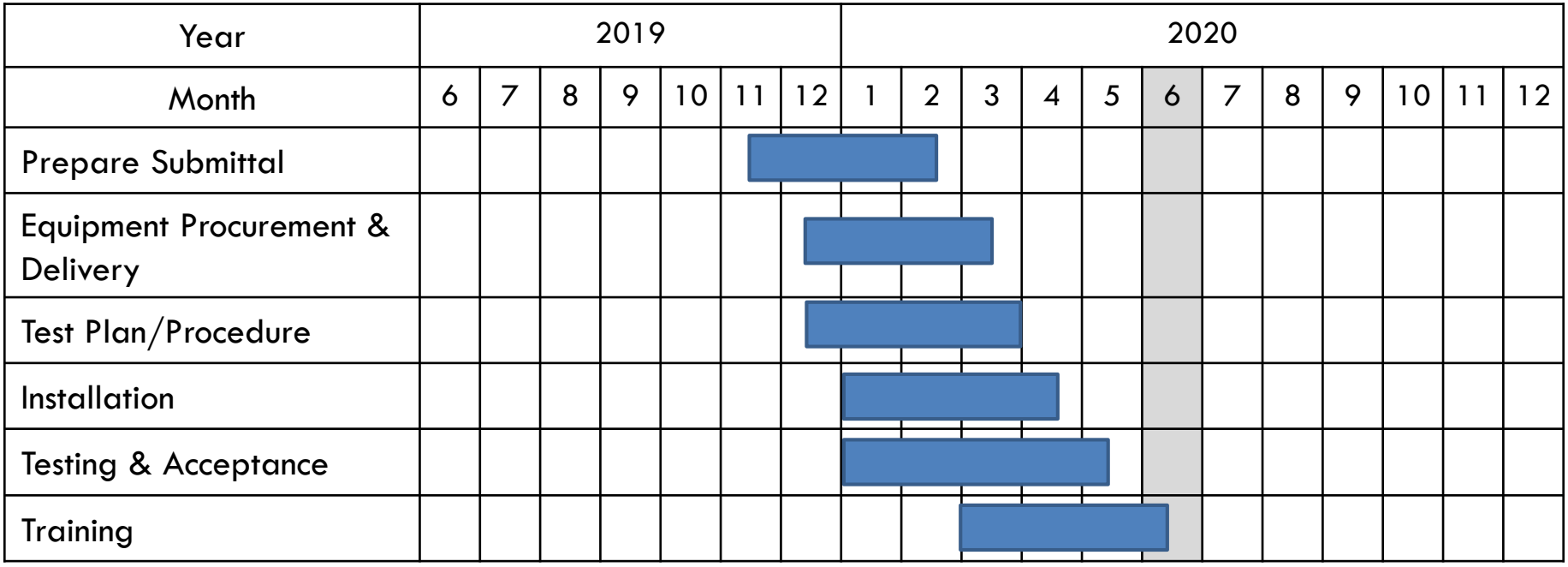
PACKAGES 1-9

Sep.17, 2019

Target Timeline - P1, P2, P4, P6, P9



Target Timeline - P3, P5, P7, P8



P3: Being Reviewed by DPAC
P5: To be Reviewed by DPAC
P7: Being Reviewed by DPAC
P8: Being Reviewed by DPAC

Hard Launch of I-210 CC System (Est.)

Update on 9 Packages

Pkg. #	Package Name	Contract #	Project Status
1	Bluetooth – Iteris Velocity	07A4470 PTM	• NTP: 7/10/2018 • Kick-off Meeting: 7/30/2018 • Submittal Approved: 8/16/2018 • Installation & Testing Completed on 5/29 & 5/30/2019 • Accepted by Arcadia, Documents Submitted • Completed
2	Bluetooth – BlueToad	07A4477 DBX	• NTP: 7/10/2018 • Kick-off Meeting: 7/30/2018 • Submittal Approved: 10/12/2018 • Installation QC checklist & Test Procedure: Ready • LA County: VM server configured on 5/15/19; field installation starting 9/24/19 • Pasadena: working with the City on communications architecture and the hardware/software needed • Expected to be completed: November 2019 (80%)

Update on 9 Packages (cont.)

Pkg. #	Package Name	Contract #	Project Status
3	New Controller Cabinets	07A4603	• Disqualified: Bids came above the SB limit (314k). • Procurement Package revised per Stakeholder comments on Pkg. 5 • Cancelled by DPAC in the week of 3/15/19 • Revised package being reviewed by DPAC • Expected to be advertised by: 10/22/19 • Expected to be awarded by: 11/18/19 • Expected to be completed: 1st Quarter, 2020
4	Communication Upgrades	07A4479 Kanaan Construction	• NTP: 7/13/2018 • Kick-off Meeting: 7/30/2018 • Submittal & RFI Approved: 5/6/2019 • Equipment procured • Installation QC checklist & testing plan being prepared • Installation being scheduled • Expected to be completed: November 2019 (80%)

Update on 9 Packages (cont.)

Pkg. #	Package Name	Contract #	Project Status
5	Firmware/Timing Plan Updates/Controller Upgrades	07A4480 CPE, Inc	• NTP: 7/17/2018 • Kick-off Meeting: 7/30/2018 • Submittal Reviewed but Required Equipment changed per Stakeholder Comment • Contractor revised price estimate ($115,695.80) lower than original amount ($171,600.00) – reviewed by stakeholders with minor comments • To finalize the revised submittal with the contractor • To present to DPAC for approval • Expected to be completed: 1st Quarter, 2020

Update on 9 Packages (cont.)

Pkg. #	Package Name	Contract #	Project Status

6	Video Detection System	07A4481 Traffic Loops Crackfilling, Inc	• NTP: 7/10/18
			• Kick-off Meeting: 7/30/18
			• 10/9/18: Conducted Site Survey
			• 10/18/18: Submittal approved
			• Installation:
			  • 18 out of 22 installations are completed (2 LA County, 5 Monrovia, 3 Arcadia, 8 Pasadena)
			  • 3 locations in Duarte – pull boxes & conduits are full; City has finished the rewiring at 1locaiton, will finish the other 2 locations by 9/27/19. Installation scheduled on 10/8-9/19
			  • 1 location in Pasadena: conduit too small. Proposed action is approved. Installation being scheduled.
			• Expected to be completed: November 2019 (90%)

7	Data Communication Module and Video Detection Software Upgrade	07A4601	• Disqualified: Bids came above the SB limit (314k). • Originally cancelled by DPAC; • Revised Package being reviewed by DPAC • Expected to be advertised by: 10/22/19 • Expected to be awarded by: 11/18/19 • Expected to be completed: 1st Quarter, 2020

Update on 9 Packages (cont.)

Pkg. #	Package Name	Contract #	Project Status

8	Advanced Traveler Information Systems	N/A	• Divided to 3 parts:
			  • DMS Procurement – to be awarded by 11/18/19
			  • Integration – to be awarded by 11/18/19
			  • Static Sign Procurement - ordered by Caltrans Maintenance Group, may take up to 6 months
			• Expected to be completed: 2nd Quarter, 2020

9	Environmental Stations with Air Quality Sensors and Open Data Systems (ODS)	07A4388 Cal Poly Pomona	• NTP: 6/29/18
			• Kick-off Meeting: 7/12/18
			• Environmental stations
			  • Roadside study done
			  • Field installation done – 6/7/19
			  • Collect data and analyze data - ongoing
			• ODS
			  • CPP continuously coordinates with PATH
			  • Face-to-Face Meeting w/ Foothill Transit & Pasadena Transit on 10/10/19
			• Expected to be completed: 1st Quarte, 2020 (80%)

Next Steps

- Package 2: Start installation in LA County; Finalize Comm. architecture & material procurement in Pasadena TMC
- Package 3: Tracking status
- Package 4: Prepare documentations; Start installation
- Package 5: Prepare justification for DPAC review
- Package 6: Schedule installation & testing
- Package 7: Tracking status
- Package 8: Tracking status
- Package 9: Support coordination

Thank You and Questions?

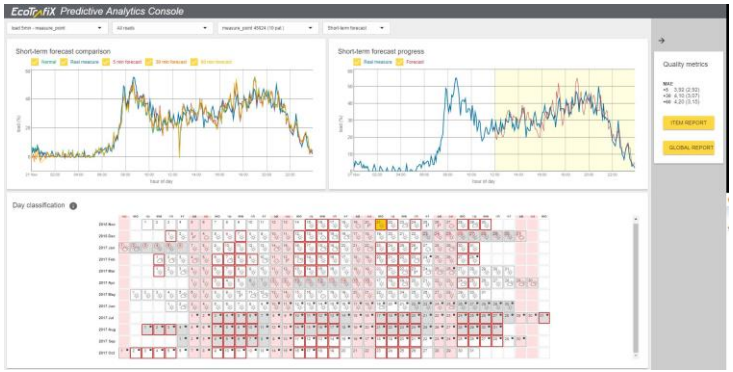
I-210 CALTRANS Pilot, September 17, 2019

Kapsch Update

Integrated Corridor Management

EcoTrafiX Product Status

- In progress:

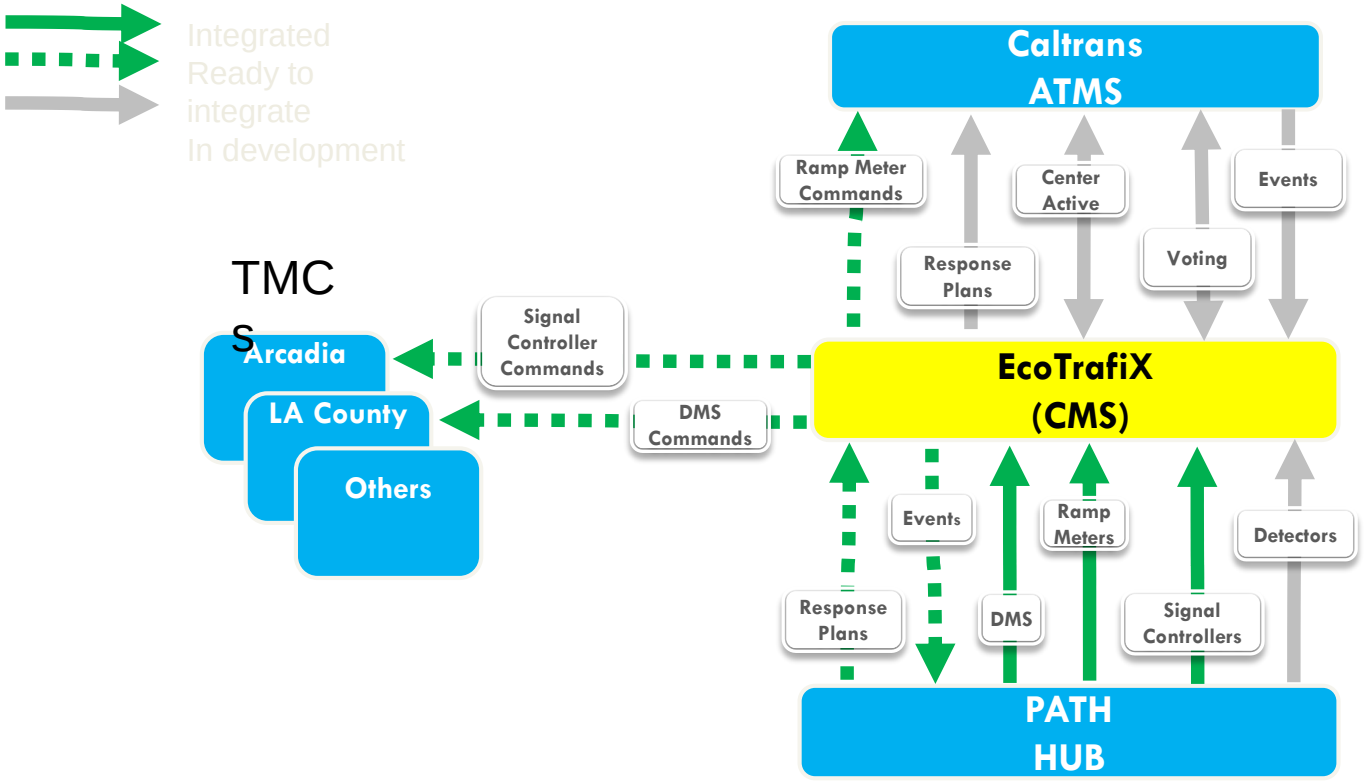


  - Product upgrade completed
    - Agency Response Plan Voting
    - Handle unexpected inventory/status ordering
    - Configure Ramp Meter icons
    - Handle full device inventory messages (vs. one-at-a-time)
  - Provide import/export access to EcoTrafiX Response Plans
  - Associate incidents with multiple ICM links/lanes and arterial movements (major product update scheduled December 2019)

EcoTrafiX Interface Status

- Publish Events to Hub – ready to integrate with DSS
- Receive Events – simulated until ATMS is available in AWS
- Response Plans – ready to receive from DSS
- Traffic Signals live from Arcadia & some LA County signals
- DMS – receiving from Hub
- Ramp Meters – receiving from Hub (simulated from ATMS)
- Response Plan Item Execution – ready to integrate with TMCs

EcoTrafiX Status

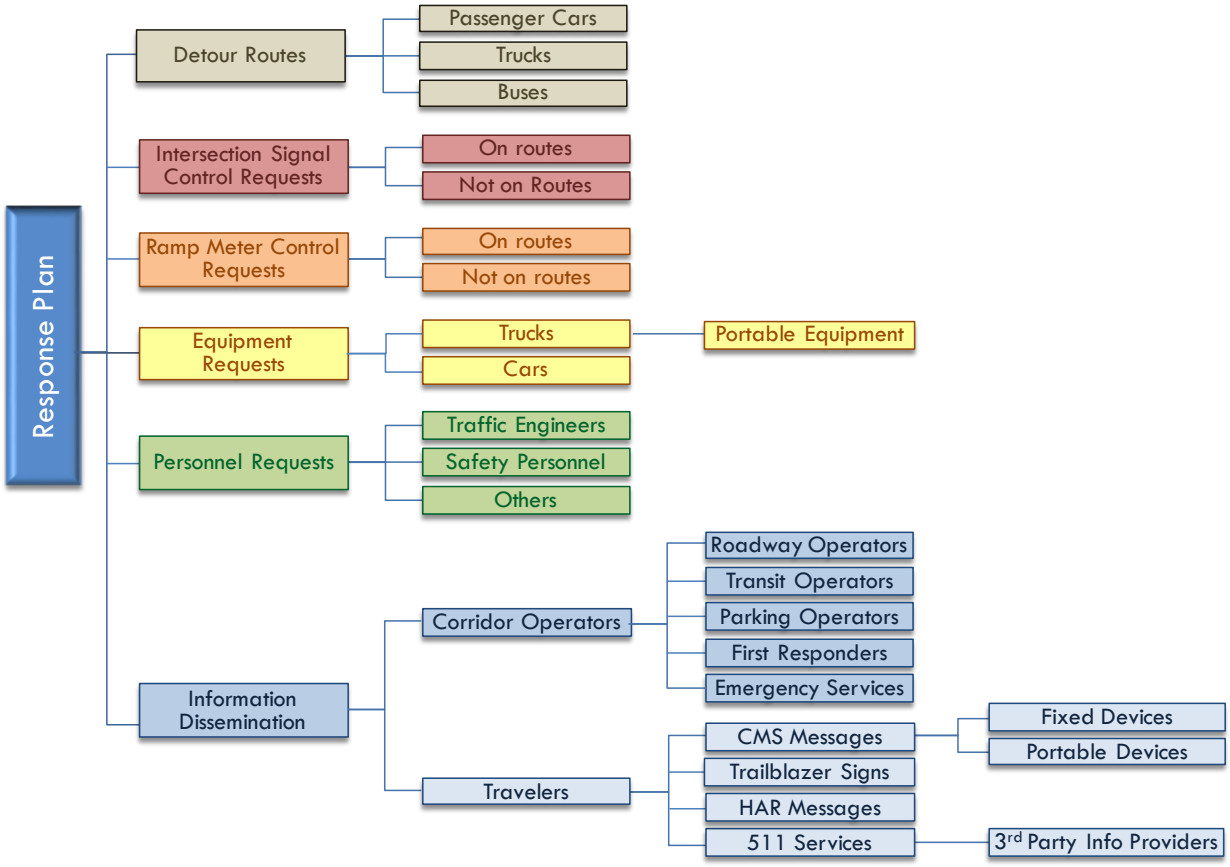


EcoTrafiX Status

- Next Steps
  - Integrate with PATH's Hub
    - EcoTrafiX send Events to HUB
    - DSS send Response Plans to EcoTrafiX
  - Integrate with CALTRANS ATMS
    - ATMS send Events to EcoTrafiX/HUB
    - EcoTrafiX exchange Voting with ATMS
    - EcoTrafiX send Response Plans to ATMS
    - EcoTrafiX exchange Center Active with ATMS

Response Plans and Predictions

Response Plan Components



Three Topics for Discussion

- **Response plan types**
  - Main incident response plans
  - After incident/recovery plans
  - Termination plans
- **Creation of response plans from Aimsun**
  - Automatic creation of files to be read into the rules engine
- **Prediction**
  - Response plans are read into Aimsun
  - Additional information is added
  - Model is run
  - Model output is processed to generate metrics which are passed back to the DSS

Response Plan Flow

1) Incident created

- Response plans generated
- Response plans run in Aimsun
- Metrics are generated
- Response plans are ranked
- Response plan is selected
- Response plan is implemented

2) Incident state revisited and new response plans generated as above

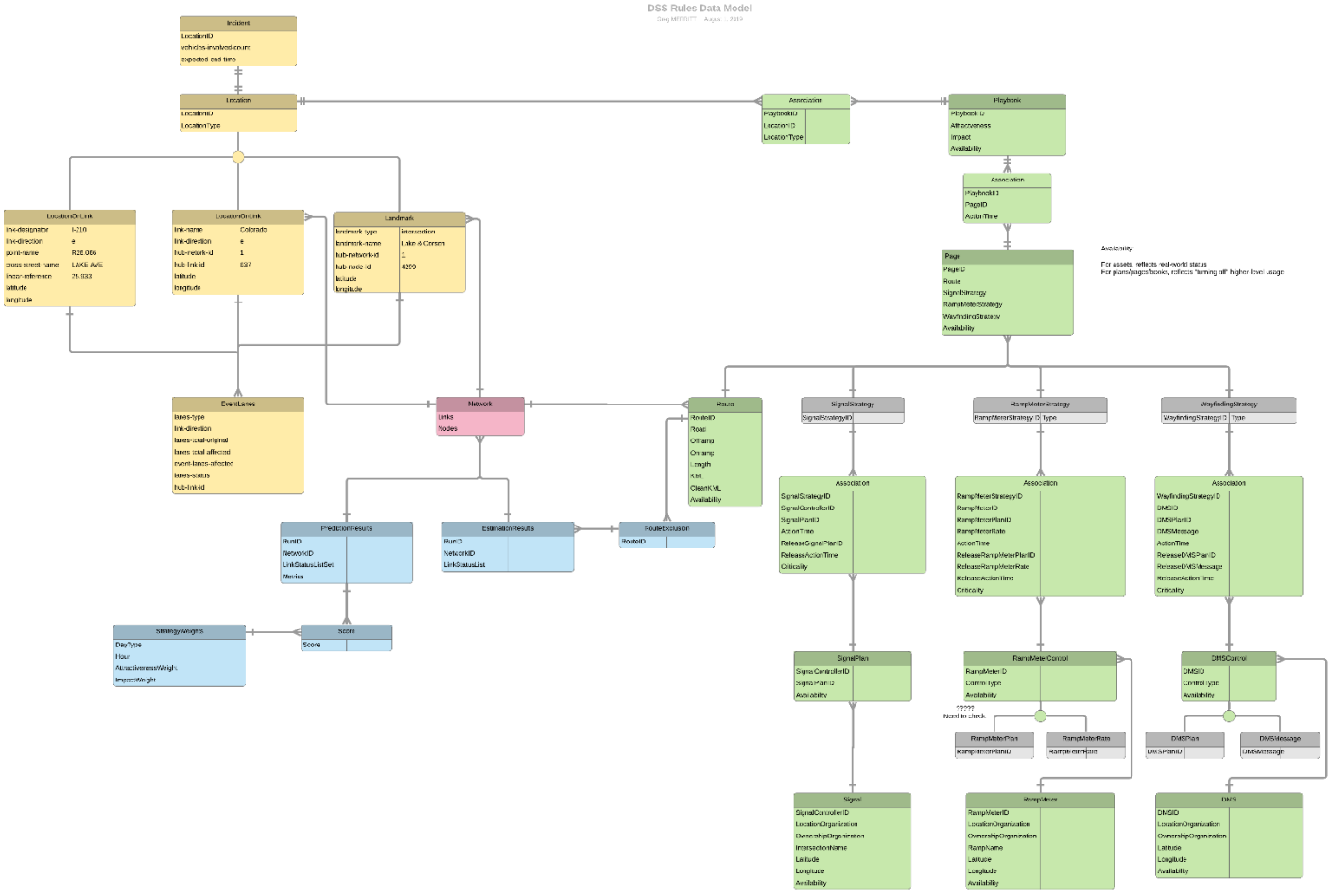
3) Incident is cleared

- Post incident/ recovery response plan is generated and approved

4) Response plans are terminated

- Using the post incident recovery response plan which includes termination instructions

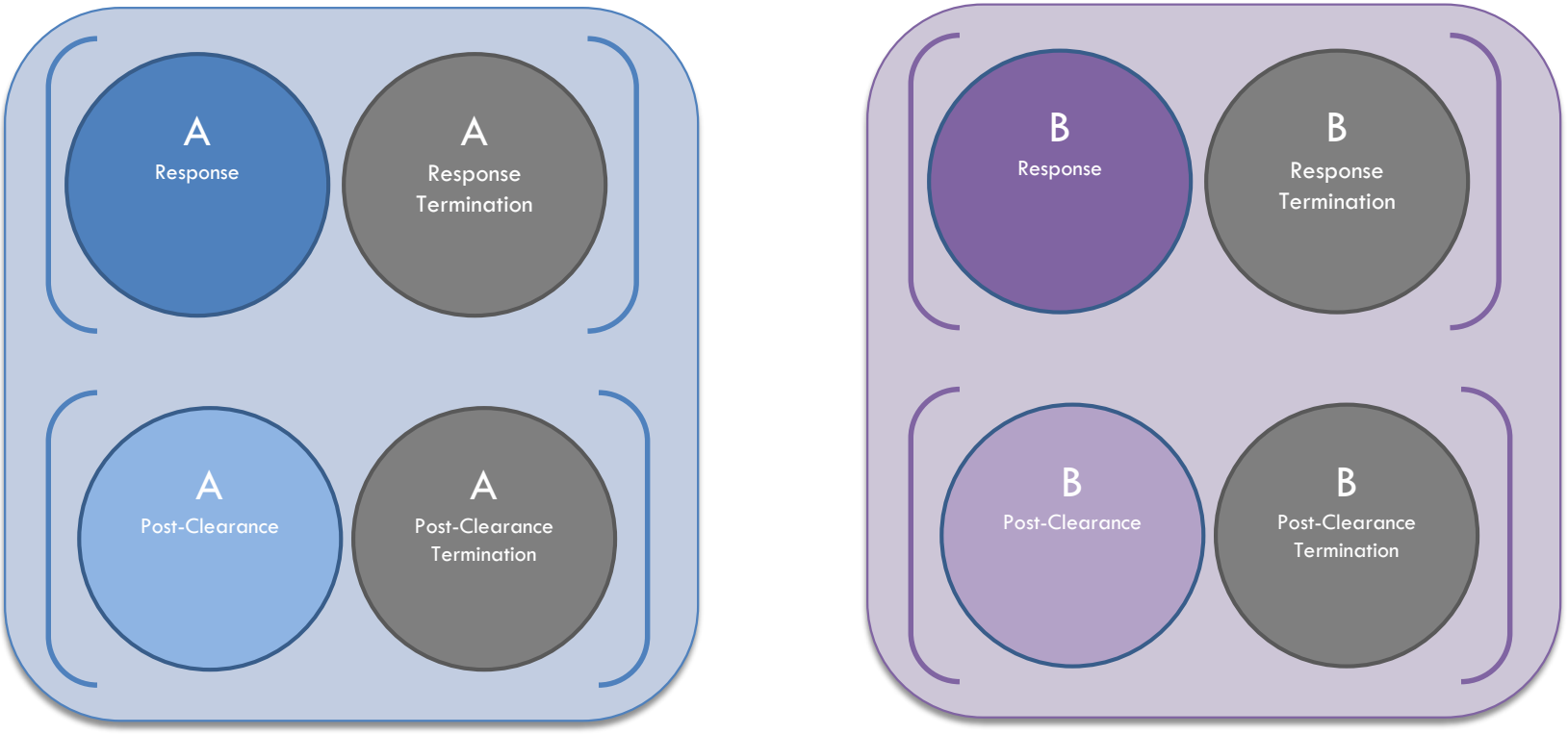
Response Plan Data Model



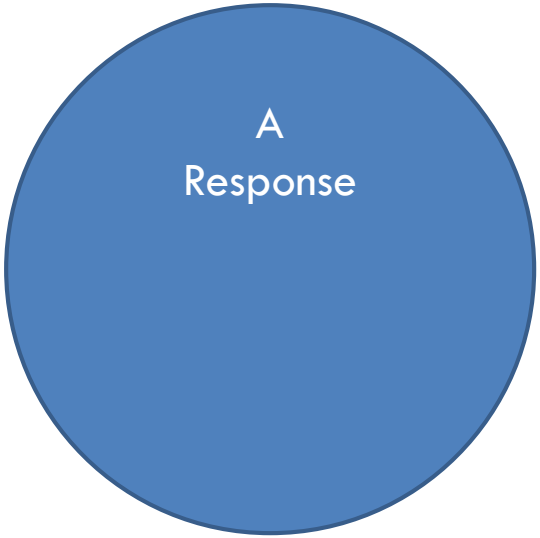
Response Plans

- **Response plans will exist in pairs**
- **There will be 2 response plans for each incident response**
  - Incident
    - Initial Action
    - Potential Termination actions if needed
  - Post Clearance
    - Post Clearance
    - Termination

Response Plan Groupings

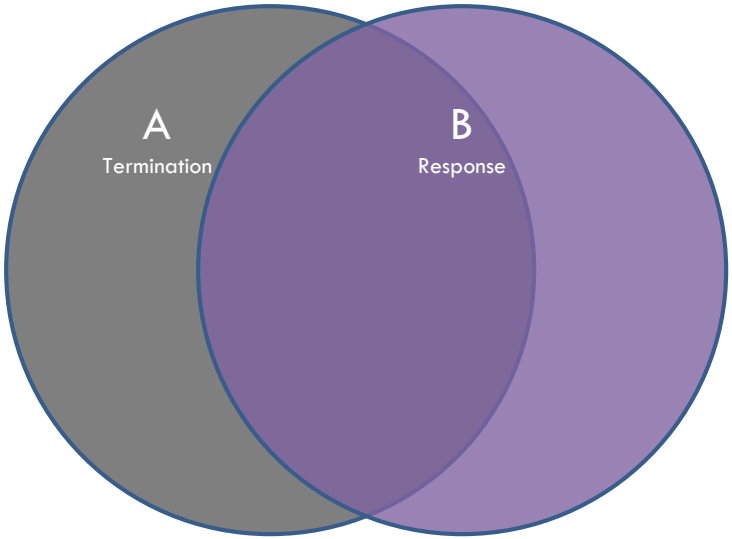


Initial Response: Plan A



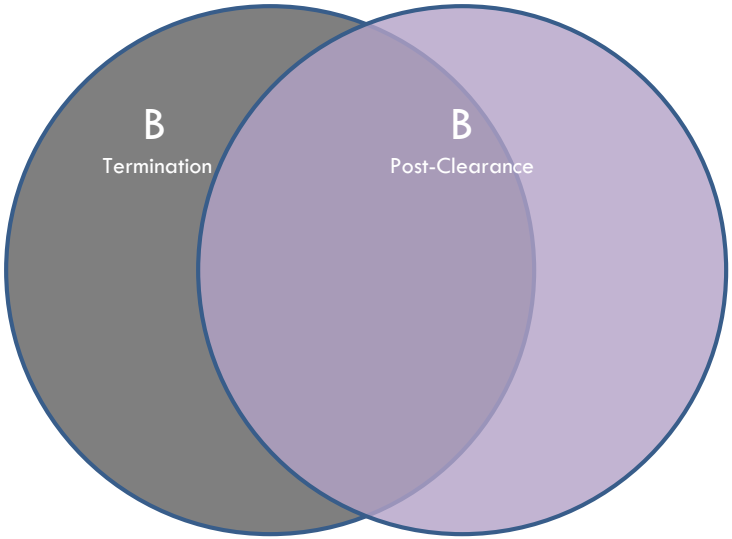
- The initial ICM response to an incident may include components such as:
  - Special intersection signal coordination
  - Ramp meter changes
  - Messages for signs

Transition from Plan A to Plan B



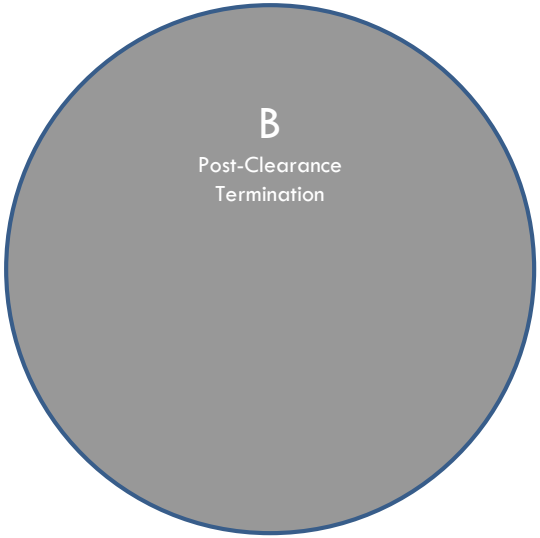
- As the incident evolves, the ICM may suggest a change in response.
- Elements from A that are not used in B are released (terminated).
- Field elements in B are given their Plan B instructions. (Some may have been in play as part of A.)

Transition to B Post-Clearance



- After incident clearance, rather than simply release (Terminate) Plan B, the ICM will transition to a Post-Clearance plan for more efficient recovery.
- This works like the A→B transition on the previous slide.

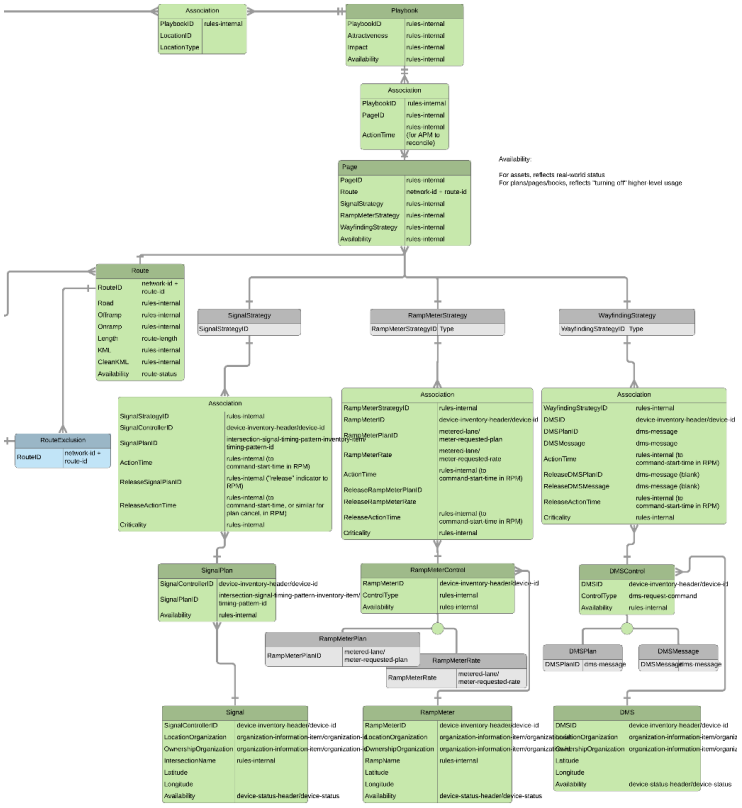
Termination of B Post-Clearance



- Once B's Post-Clearance has run its course, its elements are released (Terminated).
- The incident and response are now fully resolved in the ICM system.

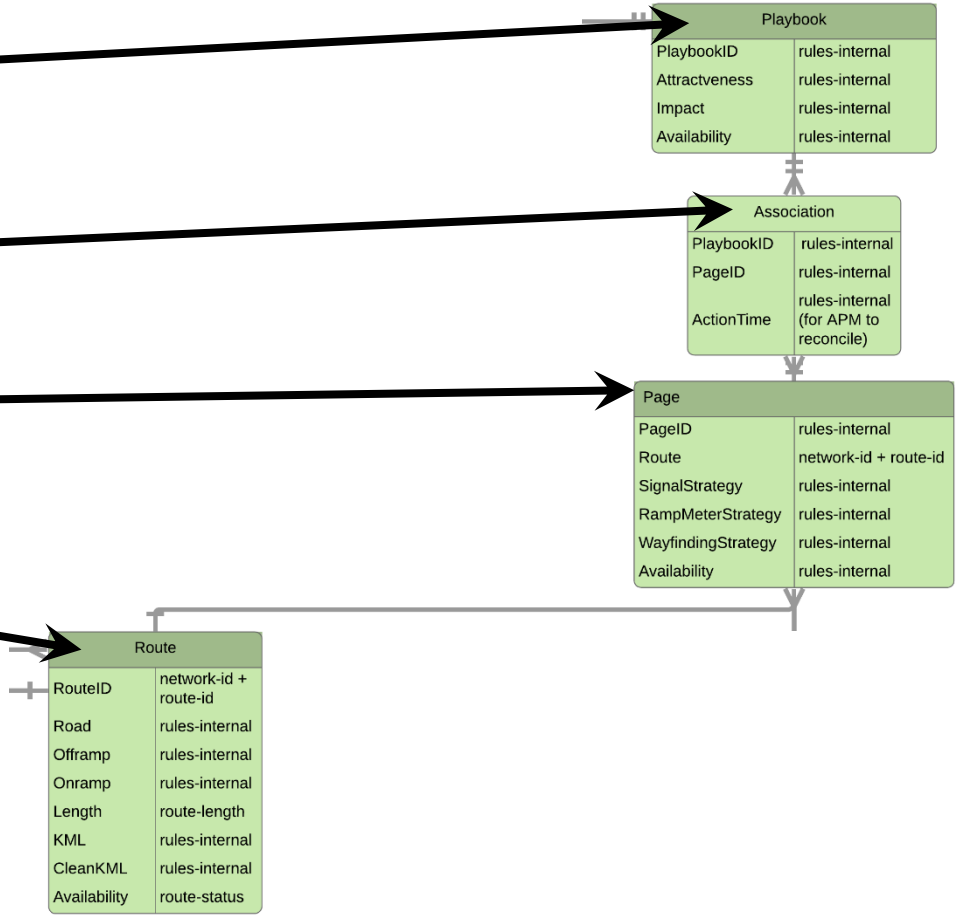
Response Plan Creation from Aimsun

- **New data model for response plans**
  - Nicely captures multi-route plans in playbooks and pages
  - Consistency checks implemented to test associations within response plan spreadsheets

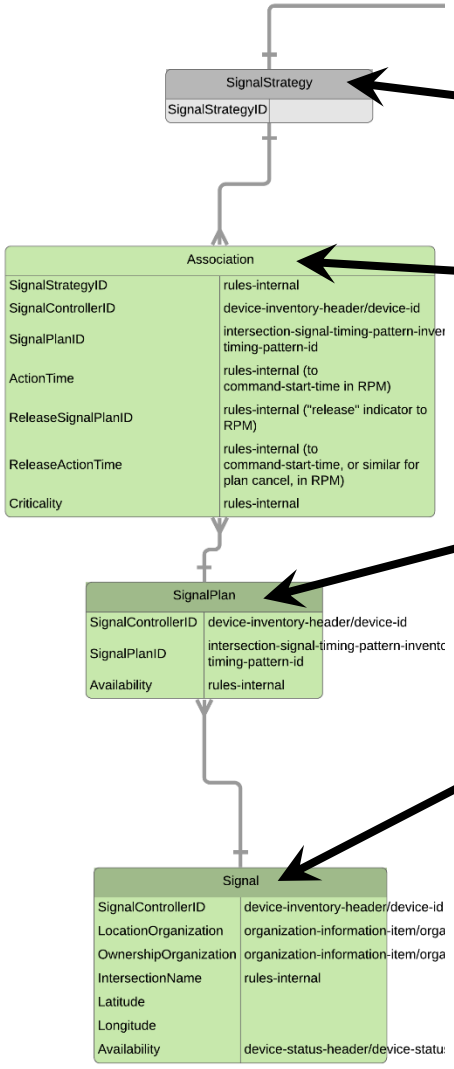


Response Plan Spreadsheet Inventory

- Playbooks (397)
- Playbook Associations (397)
- Pages (199)
- Routes (79)

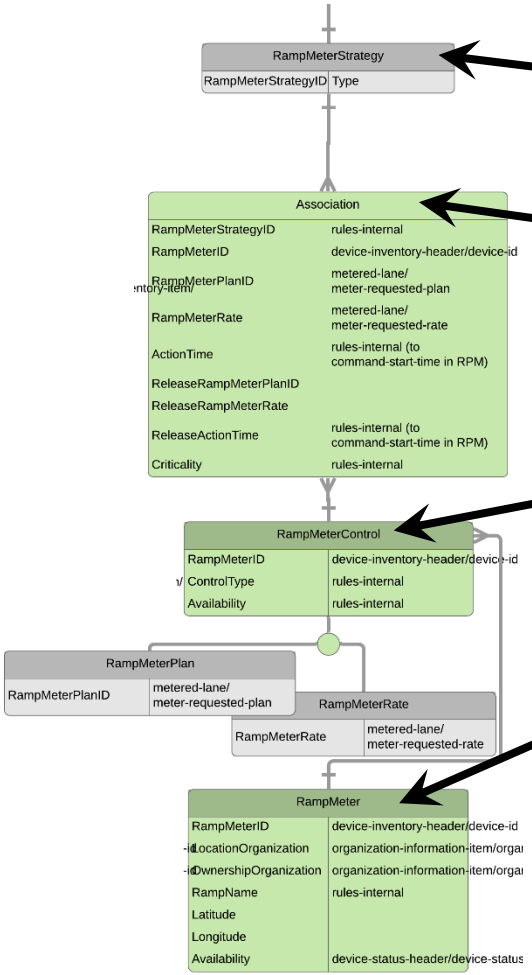


Response Plan Spreadsheet Inventory



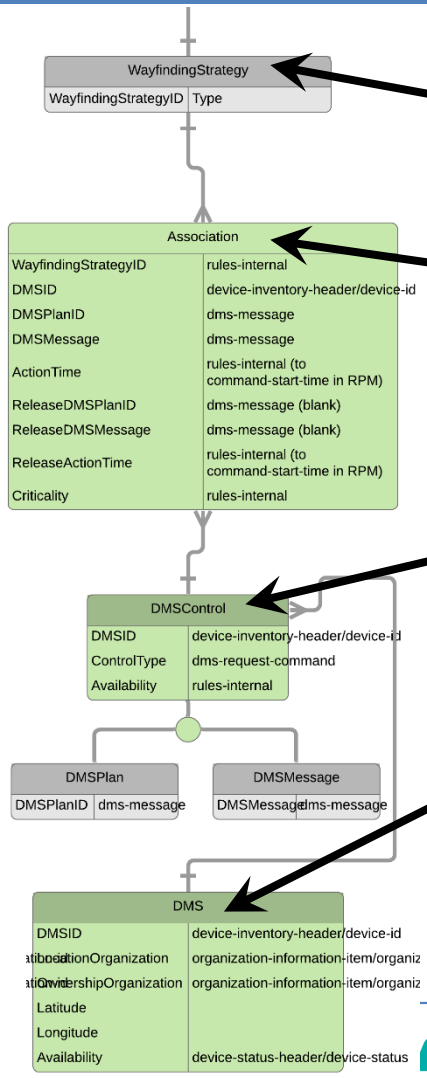
- Signal Strategies (207)
- Signal Associations (2623)
- Signal Plans (2515)
- Signal Controllers (451)

Response Plan Spreadsheet Inventory



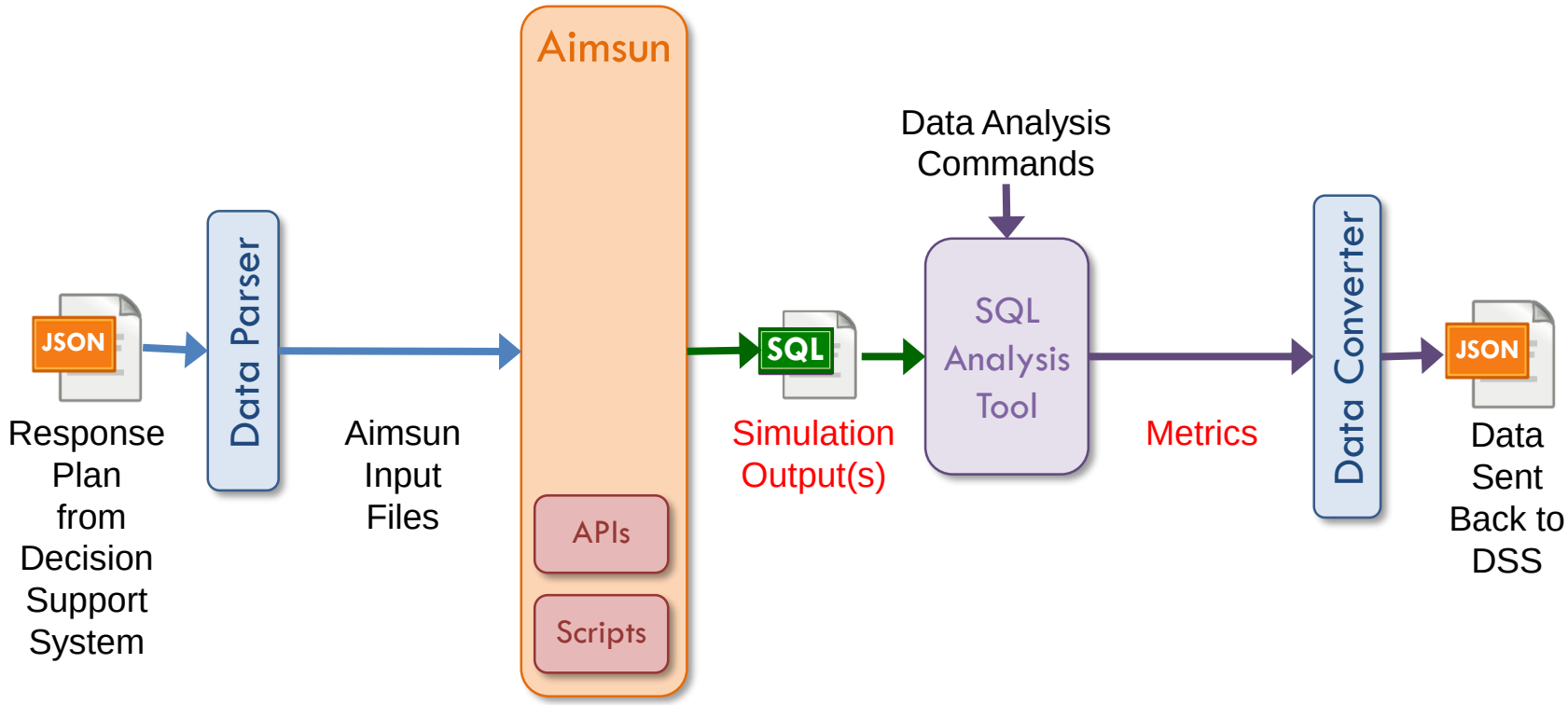
- Ramp Meter Strategies (93)
- Ramp Meter Associations (122)
- Ramp Meter Plans (63)
- Ramp Meter Controllers (63)

Response Plan Spreadsheet Inventory

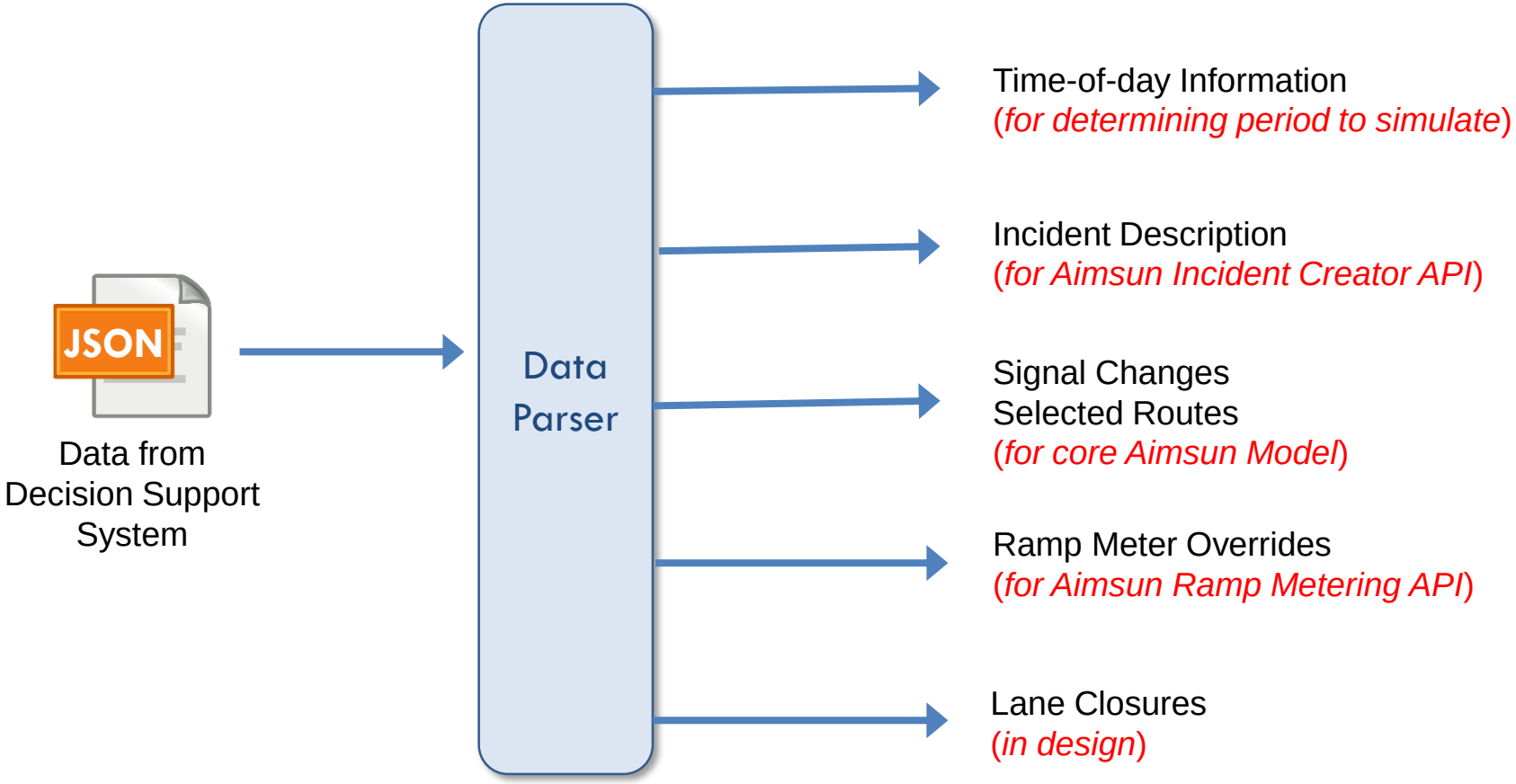


- Wayfinding Strategies (83)
- Wayfinding Associations (84)
- Wayfinding Plans (128)
- Wayfinding DMS (71)

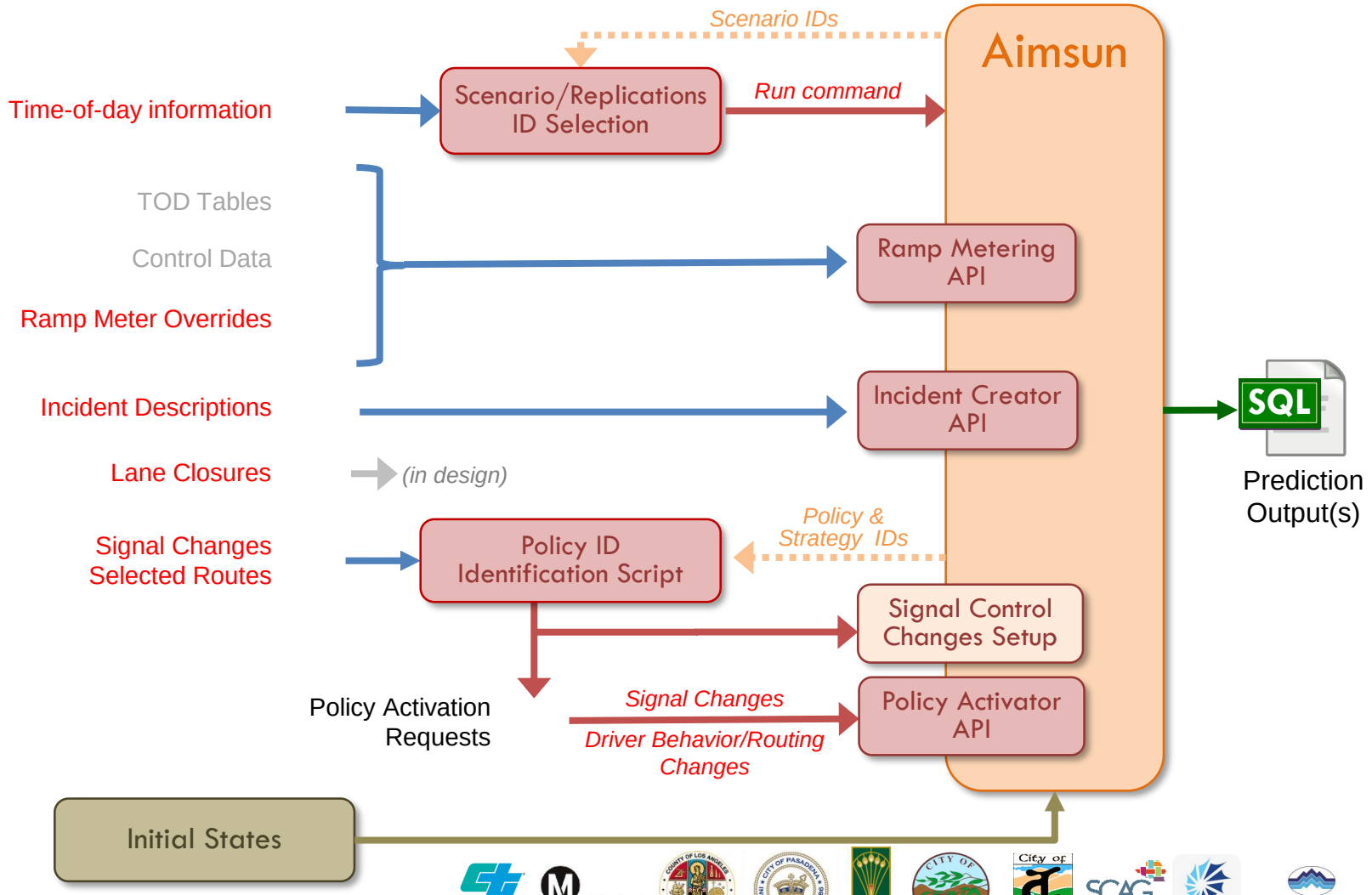
Aimsun Data Processing Overview



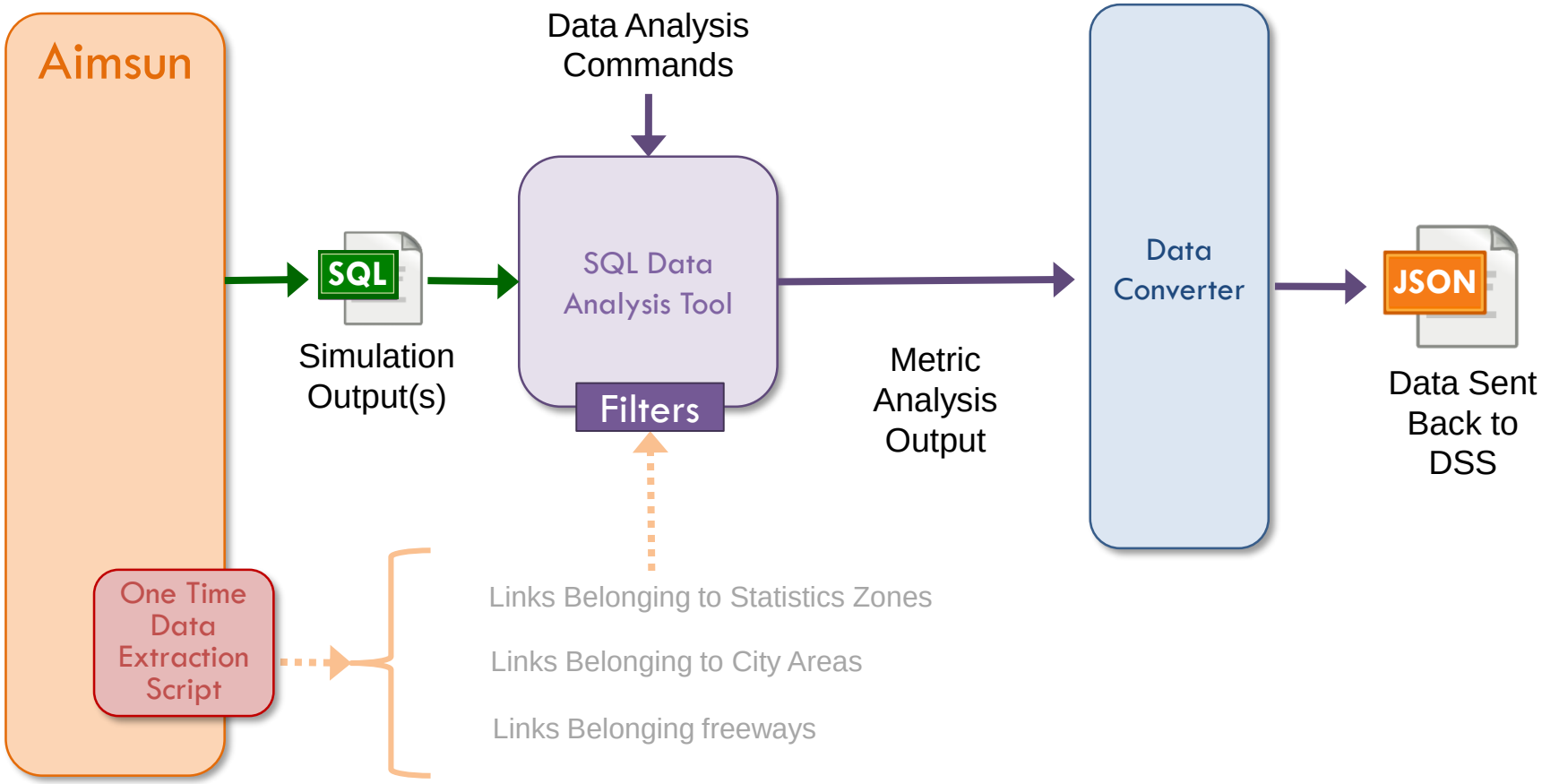
Input Data Pre-Processing



Data Input into Aimsun



Output Data Processing



System Testing in January

- **Incident information from the ATMS**
- **Generation of Response Plans**
- **Prediction output and Metrics**
- **Ranking of response plans**
- **We will not execute the plans yet as:**
  - Not all ITS elements are in place
  - We are not moving the software to the cloud until testing is done
- **We will look at what happened during the incident**
  - See if our predictions were accurate
  - Analyze our response plans and determine if they would have helped

Thank You
and
Next Meeting
(Suggest Tuesday October 29th at Duarte)