Connected Corridors
Face-to-Face Meeting

Tuesday, November 27th , 2018
1:30 – 3:30 pm
Monrovia

Agenda

- 1:30 - 1:45 - MOU – Mort
- 1:45 - 2:00 – Launch Date Update
- 2:00 - 2:30 - Summary of program - Joe
- 2:30 - 3:00 - Parsons update on Call projects
- 3:00 - 3:25 – Response Plan Discussion
- 3:25 - 3:30 – Closing
  - Next Meeting at Duarte – Tuesday January 15th
  - (County, Arcadia, Caltrans, Pasadena, Monrovia, Duarte)

MOU/Signs

Mort

Launch Date Update

Moving final launch date to end of year

- Due to delays in the delivery of our C2C interfaces and the development of the software we will not be able to do a full launch next July.
- We recommend a soft launch in July – Generate response plans but do not automatically send them to ITS devices (signals, ramps, signs)
- We recommend a hard launch end of December. A hard launch will involve sending commands to the ITS devices
- These dates are under some discussion

Soft Launch Description

- **In July we launch with:**
  - The data feeds that are ready - Arcadia, ATMS, Others maybe
  - The Kapsch system
  - The Data Hub
  - The Decision Support system with rules using live inventory checking
- **We review data quality and work to improve it**
- **When an incident is entered via the ATMS or the Kapsch system we run the DSS and generate response plans.**
  - We review these plans afterwards using the model and the data we have stored
  - Make appropriate changes
- **We complete system integration and perform testing from July to December**
- **As we deem systems ready we begin to test by setting values on real ITS field elements, one stakeholder at a time, and then the overall system**
- **We do a hard launch in January**

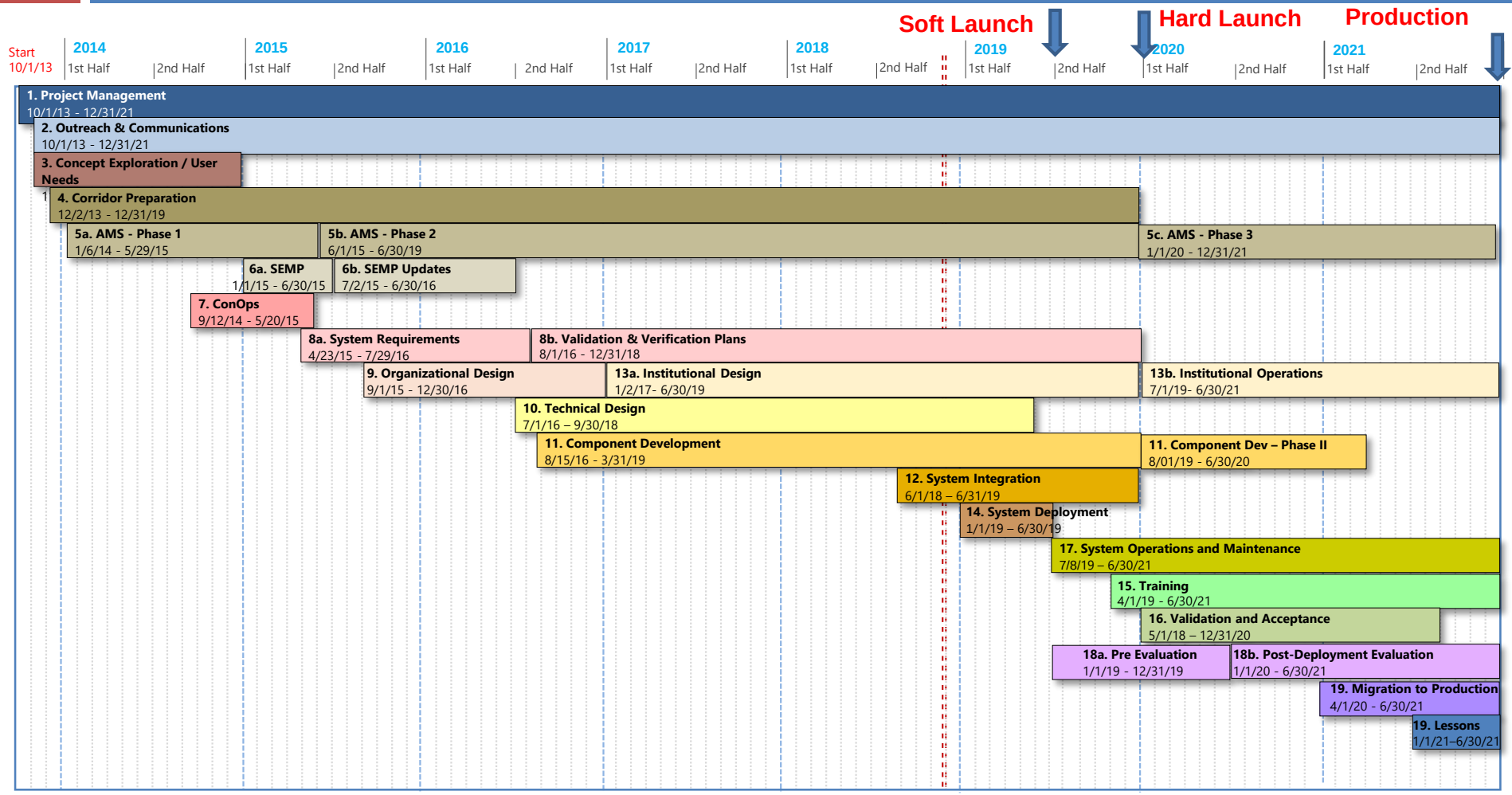
Soft Launch

- **Initial response plans will use rules and not modeling**
  - Live status information for all assets with live feeds
  - Assume all assets are available and working for jurisdictions without live feeds.
  - Limitations on time of day for use of certain routes
- **Post Incident:**
  - Response plans can be reviewed in the prediction model.
  - This will allow us to analyze how they might be expected to perform and make adjustments to the response strategies, timing plans, and route strategies.

Build Confidence and Reduce Risk

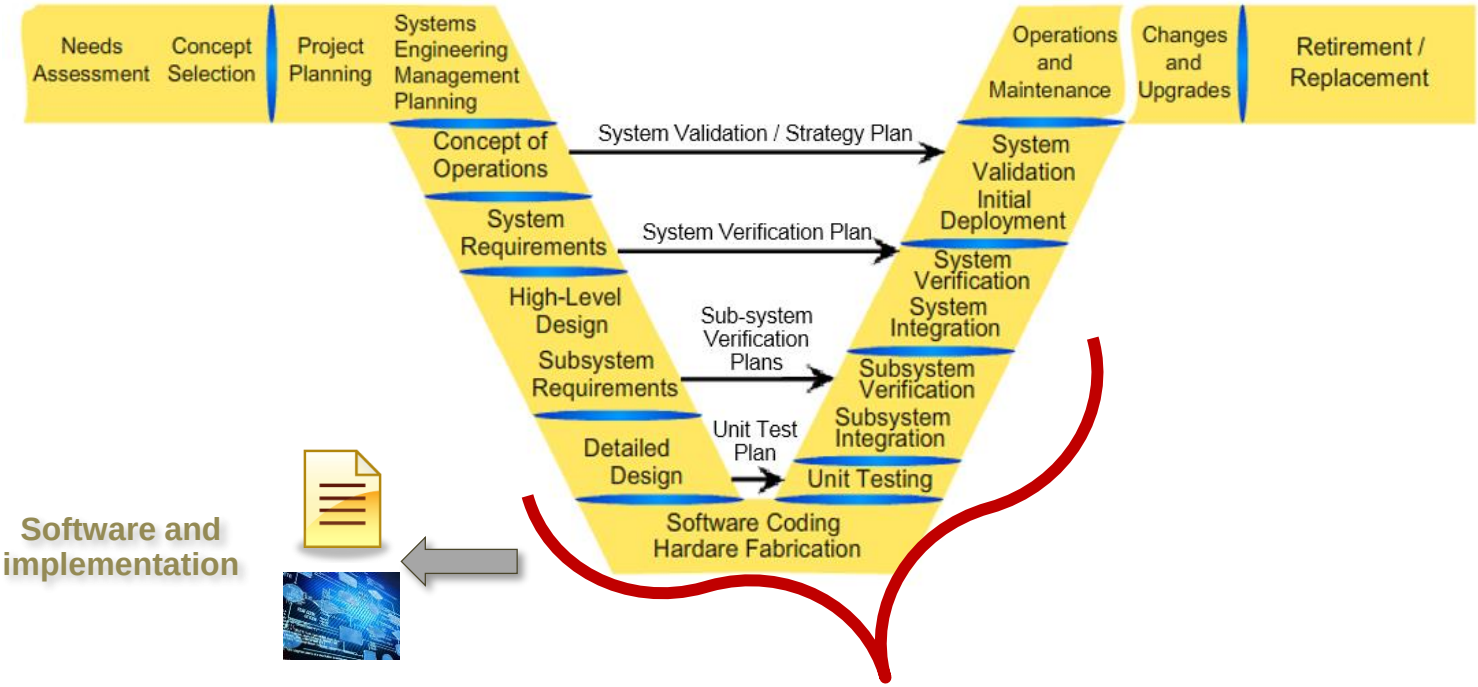
- **Overall:**
  - Gives more confidence in our response strategies
  - Reduces risk in the technical system
  - Provides a good opportunity for the reengagement of safety pesonnel

Updated Schedule



Systems Engineering Next Steps

- Design Documents – Details of interfaces and implementations
- Hardware/Software – Building the system
- Integration – Subsystems will come on line this year



Summary

Caltrans Data Quality: Good!

- **I-210 PM 25 - 43.25**
  - EB 89.8% --- good, should improve next week
  - WB 80.4% --- should improve next week
- **SR-134 PM 11.4 - 13.5**
  - EB 78.3% --- sporadic data from MSID 4200
  - WB 69.0% --- sporadic data from MSID 4200
- **I-605 PM 22.93 – 28**
  - NB 83.2% --- recent drop from last week
  - SB 87.2% --- recent drop from last week

Signal Plans and DSS Review

- **Caltrans Signal Plan Review & Approval**
  - Flush plans and space-time diagrams on Central/Evergreen provided to Samson for review
- **Pasadena Signal Plan Review & Approval**
  - Agreement on procedures for signal plan submission
  - 150 intersections agreed upon where the plans to be updated
  - Established a shared Box Folder to communicate plans
  - Pasadena has agreed to enter these plans into the Transparity system
- **DSS Workflows and Rules**
  - First cut completed of rules spreadsheets to specify allowable combinations of proposed routes, signal plans, ramp meter plans, and wayfinding signs

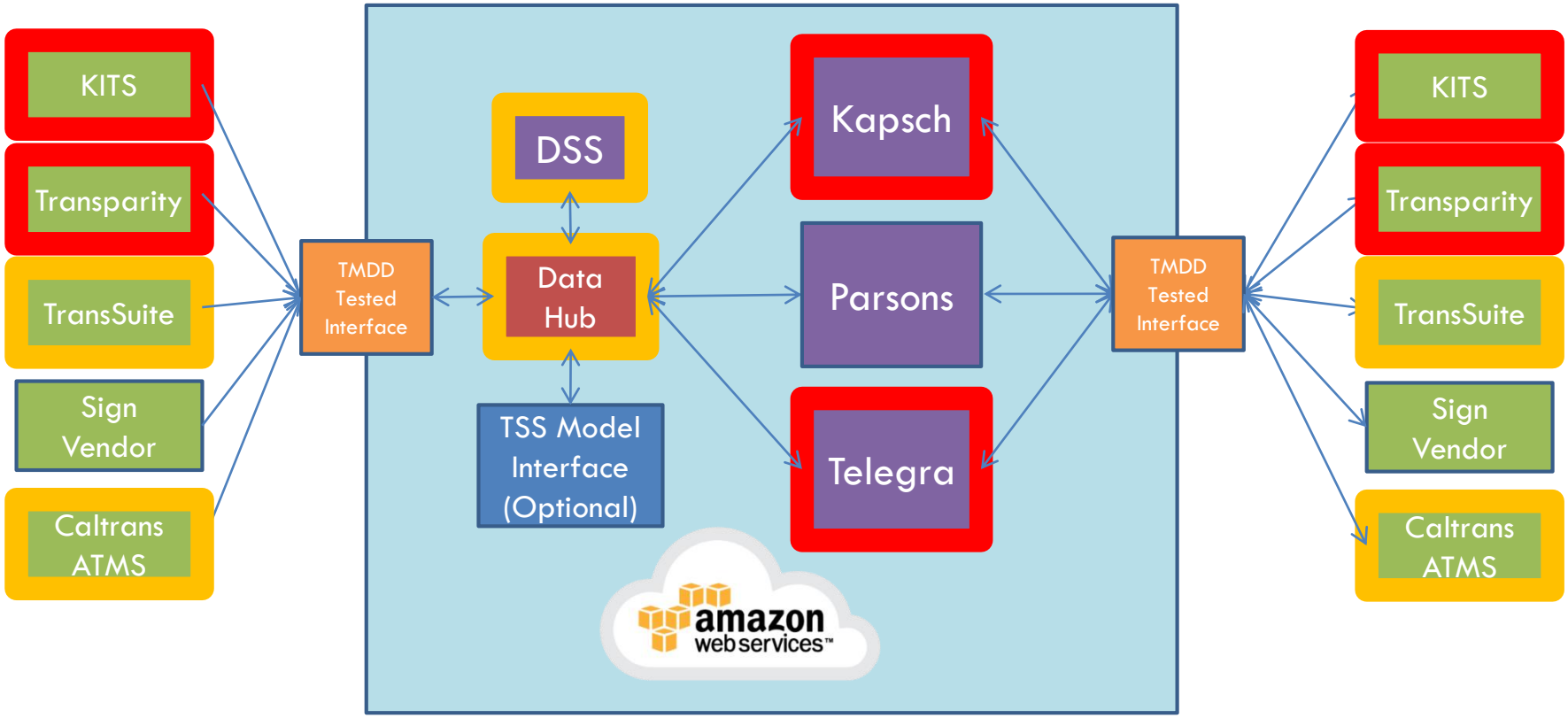
Response Plan Generation

- Response Plan workshop at the D7 TMC – Much discussion
- Improvements to the desktop application's logging and mapping output
- Internal discussions of Response Plan trigger threshold and scoring
- Discussions of incident location limitations and opportunities -- both internal and with David Lau – Detailed discussions to begin
- Initial meeting with writer on Response Plan documentation

Communication – Kali to Comment

- **Pasadena VPN connection will be in place by the end of January**
- **LA County connection is in place! We will be testing it in December**
- **RIITS and PATH continuing to work:**
  - DNS – Domain Name Servers
  - Hostnames
  - SSL certificates

C2C Interface Implementations - Status



TMDD Interfaces to Data Hub

- **Traffic Control Systems**
  - TransCore – Arcadia and Caltrans
    - Installed in Arcadia, planned for install in Caltrans in January
    - We are now reading data from Arcadia
  - McCain - Pasadena
    - In design
  - Kimley Horn – LA County, Monrovia and Duarte
    - In design

- **ATMS – Caltrans (CMS Signs, Ramps)**
  - Initial release delivered in July
  - We are testing out the interface and have identified some updates that are needed
  - We also need integration support

Systems Development and Integration

- **Cloud Infrastructure**
  - Automating deployment for AWS – Deployment to Spark completed. Continuous Integration strategy has been developed and reviewed with Amazon. Will implement this next.
  - Goal is to turn off our Blue Dev environment (publicly accessible) before Christmas and begin working and deploying within the D7 private space in January.

Systems Development and Integration

- **DSS**
  - Continued working on response plan generation and workflow orchestration between DSS, Data Hub, and Corridor Management System.
    - Early version of timed response plan updates (30 minutes after first response plan and 15 minutes after each subsequent response plan).
    - Early version of incident update handling/response plan generation

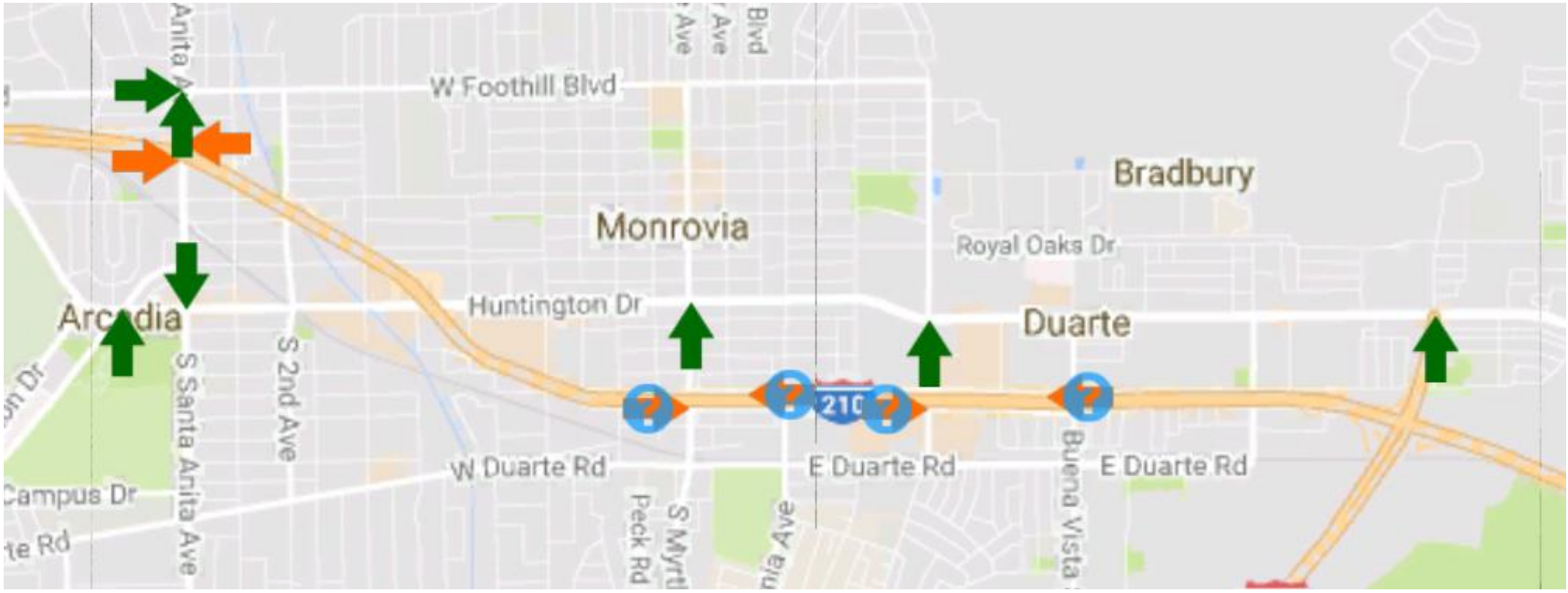
Systems Development and Integration

- **Data Hub**
  - Pipeline control in place for all pipelines (start/stop). Integrated with automated deployment and configuration. Will continue to improve this capability.
- **Corridor Management System**
  - Continue efforts with Kapsch – good discussions regarding incident messaging, interfaces
  - Started integration efforts with Telegra Corridor Management System (with the ATMS)
- **Integration (Data Sources)**
  - Successful integration with Arcadia

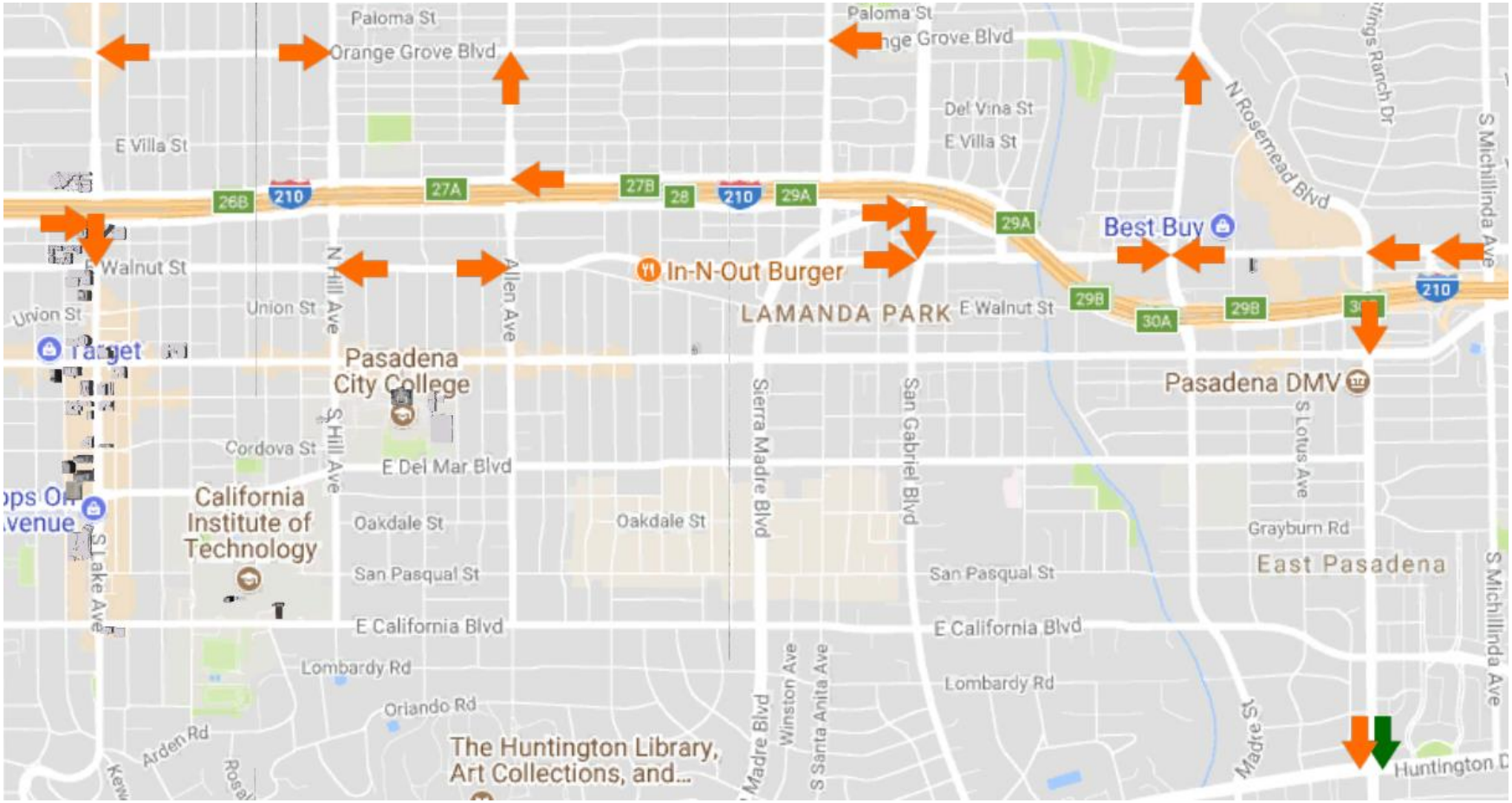
Signs - New Guidelines

- **No arterial wayfinding signs in Arcadia, Monrovia and Duarte**
- **Use major arterials to reroute traffic**
  - Huntington
  - Foothill
- **Place signs to ensure travelers are directed to Huntington and Foothill**
  - Static signs as needed
  - Dynamic message signs on Caltrans ramps as needed
- **Once on Huntington and Foothill travelers will drive until they come to a junction with I-210. They will not be directed to make a turn in order to return to the freeway earlier**

Final Recommendations
Arcadia, Monrovia and Duarte



Final Recommendations
Pasadena and LA County



Call for Projects
Parsons

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

November 27th, 2018

Project Objective

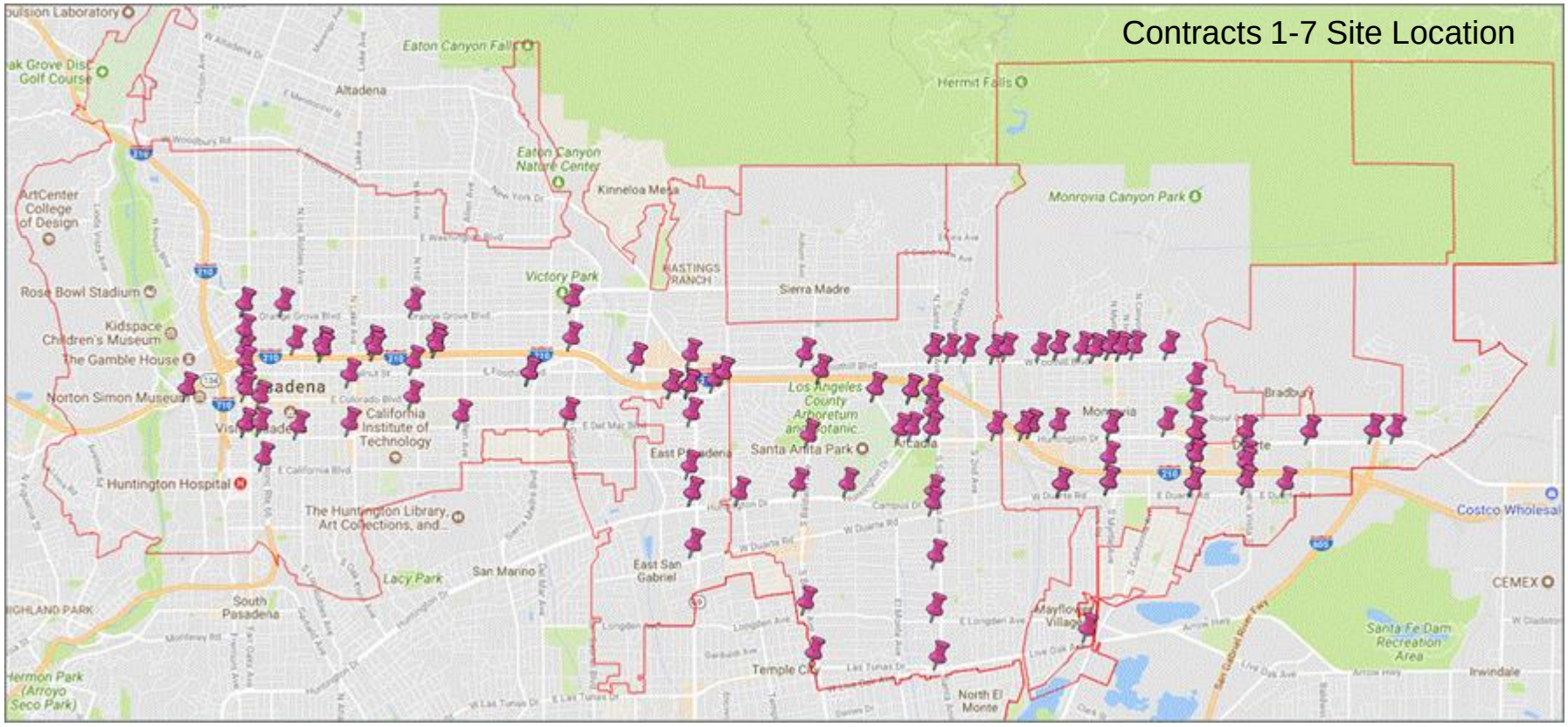
- Assist Caltrans D7 to manage and coordinate the execution of the 9 arterial ITS improvement projects

#	Package Description	Contract #	Contract Status
1	Bluetooth – Iteris Velocity	07A4470	Awarded
2	Bluetooth – BlueToad	07A4477	Awarded
3	New Controller Cabinets	07A4603	Package being updated Being Re-advertised
4	Communication Upgrades	07A4479	Awarded
5	Firmware/Timing Plan Updates/Controller Upgrades	07A4480	Awarded
6	Video Detection System	07A4481	Awarded
7	Data Communication Module and Video Detection Software Upgrade	07A4601	Being Re-advertised
8	Advanced Traveler Information Systems	N/A	Divided to 3 packages To be advertised
9	Environmental Stations with Air Quality Sensors and Open Data Systems	07A4388	Awarded

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.)



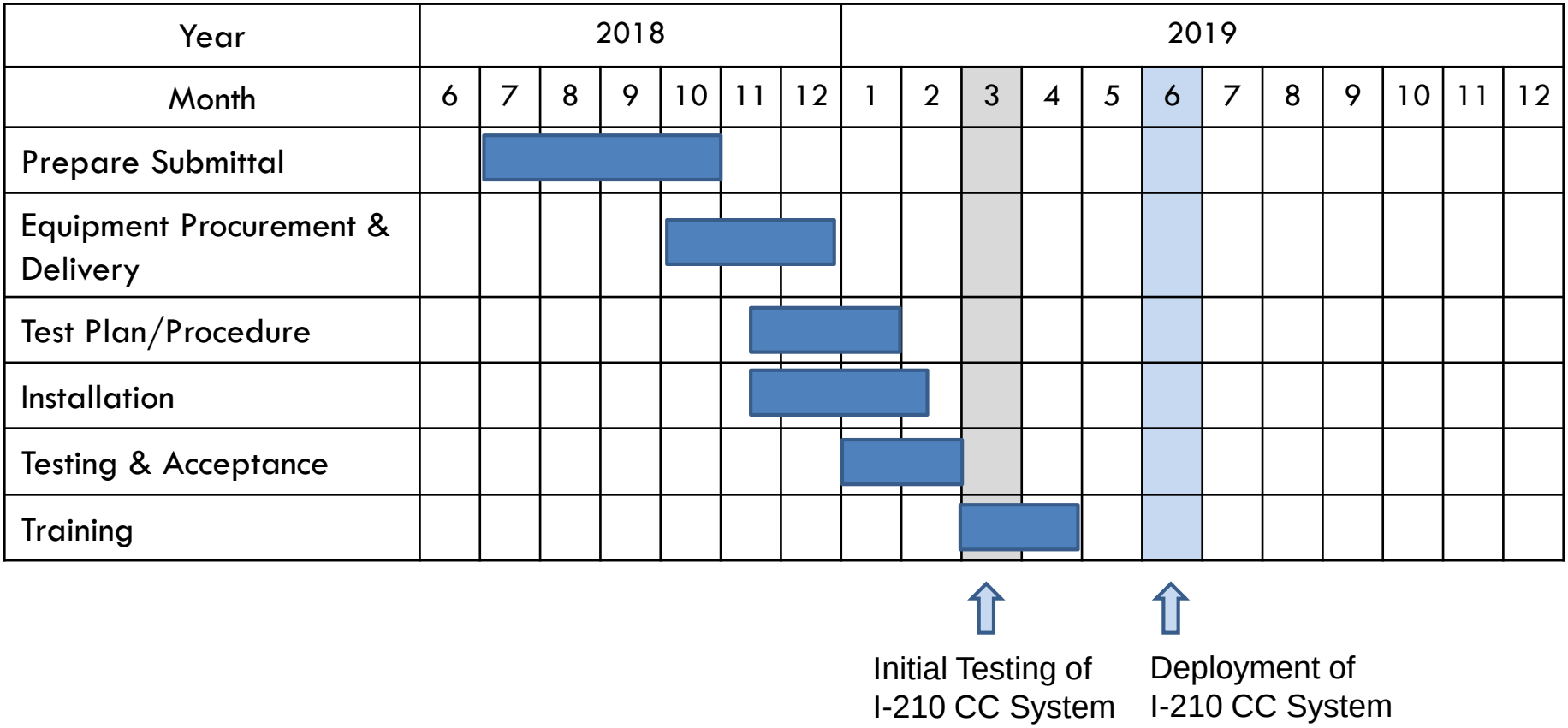
Caltrans Metro Foothill Transit

UPDATE ON

PACKAGES 1-9

November 27th, 2018

Estimated Timeline



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 • Equipment has been procured • Starting permit application process • Expected to be completed: Mar 2019 (90%)

2	Bluetooth – BlueToad	07A4477 DBX	• NTP: 7/10/2018
			• Kick-off Meeting: 7/30/2018
			• Submittal Approved: 10/12/2018
			• materials to be ordered in December
			• Starting permit application process
			• Current Schedule
			  • Order Equipment: 12/17/18 – 1/7/19
			  • Pre-Configure BlueTOAD Spectra Units: 1/7/19 – 1/11/19
			  • Download/Configure Server Software: 1/14/19 – 1/18/19
			  • Begin BlueTOAD Spectra Unit Installation: 1/22/19 – 2/15/19
			  • Acceptance Test Plan Completed: 1/22/19 – 2/15/19
			  • Acceptance Test Report: 2/4/19 – 3/1/19
			• Expected to be completed: Mar 2019 (90%)

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 • Resubmittal is being reviewed by DPAC for approval • To be re-advertised • Expected to be awarded: Dec, 2018 - Jan, 2019 • Expected to be completed: Jun, 2019
4	Communication Upgrades	07A4479 Kanaan Construction	• NTP: 7/13/2018 • Kick-off Meeting: 7/30/2018 • Makes, models for cabinets at specific locations have been received and shared with the contractor. • Expected to be completed: Mar 2019 (70%), May 2019 (90%)

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 and Required Equipment changed per Stakeholder Comment • Contractor has been given revised requirements on the controller configuration from all 3 jurisdictions • Contractor revising submittal • Expected to be completed: Mar 2019 (80%), May 2019 (90%)

Update on 9 Packages (cont.)

Pkg. #	Package Name	Contract #	Project Status
6	Video Detection System	07A4481 Traffic Loops Crackfilling, Inc	• NTP: 7/10/2018 • Kick-off Meeting: 7/30/2018 • Submittal v3 being revised per stakeholder comments on v2 and to be re-submitted • 10/9/2018: Conducted Site Survey • 10/18/18: Submittal approved • 11/2/2018: Permit to Pasadena applied, need to wait until new signal timing for 3 intersections are provided • 11/26/2018 – 11/30/2018: plan to start installation in Pasadena after permit is issued. • Expected to be completed: Mar 2019 (90%)
7	Data Communication Module and Video Detection Software Upgrade	07A4601	• Disqualified: Bids came above the SB limit (314k). • Resubmittal is being reviewed by DPAC for approval for re-advertisement • Expected to be awarded: Dec, 2018 - Jan, 2019 • Expected to be completed: Jun, 2019

Update on 9 Packages (cont.)

Pkg. #	Package Name	Contract #	Project Status

8	Advanced Traveler Information Systems	N/A	• Revised parts of Package 8 have been resubmitted with updated pricing, TMDD interface requirements, and estimated TMDD software costs:
			  • DMS Procurement
			  • Static Sign Procurement
			  • Integration
			• Expected to be awarded: Jan-Feb, 2019
			• Expected to be completed: Aug, 2019

9	Environmental Stations with Air Quality Sensors and Open Data Systems (ODS)	07A4388 Cal Poly Pomona	• NTP: 6/29/2018 • Kick-off Meeting: 7/12/2018 • Cal Poly Pomona coordinated with Caltrans & Parsons to get test data in TMDD format from D7 ATMS Test Server to feed Open Data System; Initial Testing in Dec 2018 • Coordination meeting between Cal Poly Pomona and PATH Scheduled on 11/30/2018 to discuss data interface to I-210 CC data hub • Ready for ESS field installation in Jan, 2019 • Expected to be completed: Jun, 2019 (90%)

Next Steps

- **Advertise Packages 3, 7, & 8**
- **Support Contractors to understand & address the submittal review comments**
- **Support Contractors to schedule site investigation and get permit**
- **Collect and distribute detailed master schedule when it is ready**

Thank You and Questions?

Environmental Impact Evaluation for I-210 Connected Corridor Pilot Project

Xinkai Wu, Ph.D.; Xudong Jia, Ph.D., PE; Cal Poly Pomona
Allen Chen, PE; Geromar, Hasta; Leila Sy; Caltrans District 7

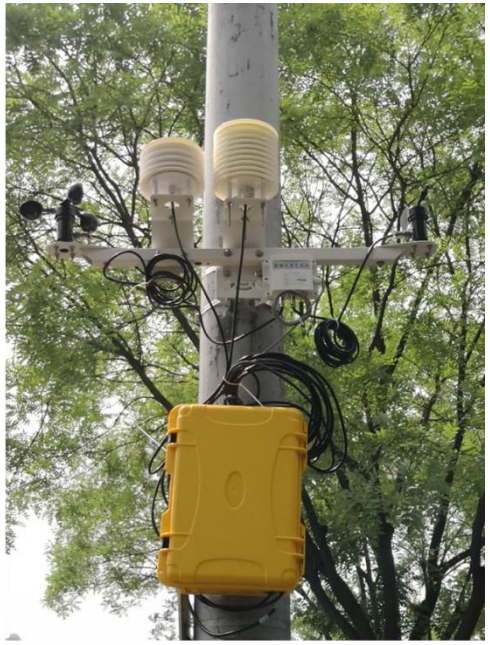
Nov. 27, 2018

Task Needs

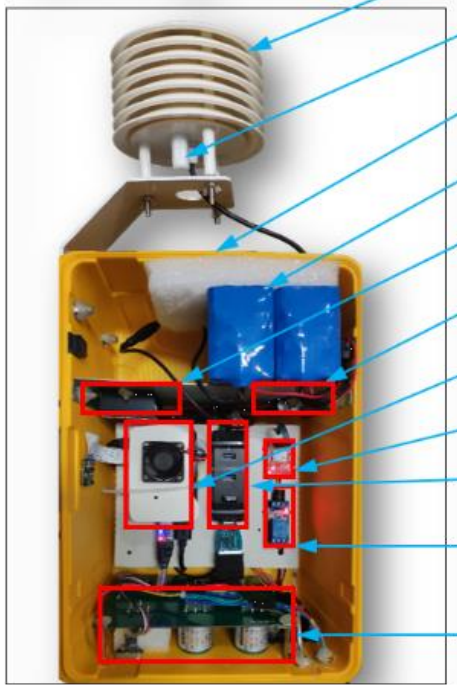
- To evaluate the air quality before and after the deployment of the CC project, the project needs to collect high frequency data including:
  - Toxic gases (CO, NO, NO2, O3, SO2, CO2);
  - Particulates (PM1, PM2.5, PM10);
  - Meteorological data (temperature and relative humidity); and
  - Potential traffic data (traffic flow, vehicle types, speed, etc.).
- Other specific features include:
  - Allow remote access for customized data collection and configuration through Linux system;
  - Support 3G/4G cellular communication through multiple carriers;
  - Low power usage;
  - Support to use solar panel power;
  - An integrated device that supports data collection and transmission;
  - Portable;
  - Provide ready-to-mount for easy implementation;
  - Provide a camera for field condition monitoring;
  - Provide unique feature of traffic data collection (optional); and
  - Low-cost.

Device: iAQBox

- iAQBox (intelligent Air Quality measure Box)
- A Roadside Air Quality Measurement Device, customized from CLR Analytics Inc.
- Fulfill all required functions
- Portable
- Low-cost
- Solar power supported

iAQBox: Overview



Wind speed & direction, camera

PM2.5 & PM10 detector

Temperature & Humidity detector

Waterproof box

Built-in battery

12V Solar charge controller

12V to 5V Voltage converter

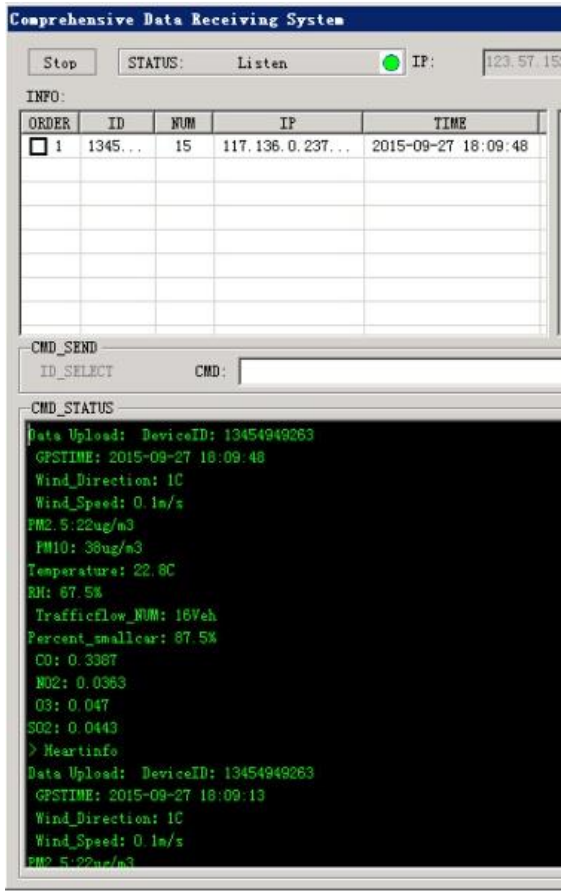
Raspberry pi 3b

GPS Module

USB3.0 4Port Hub

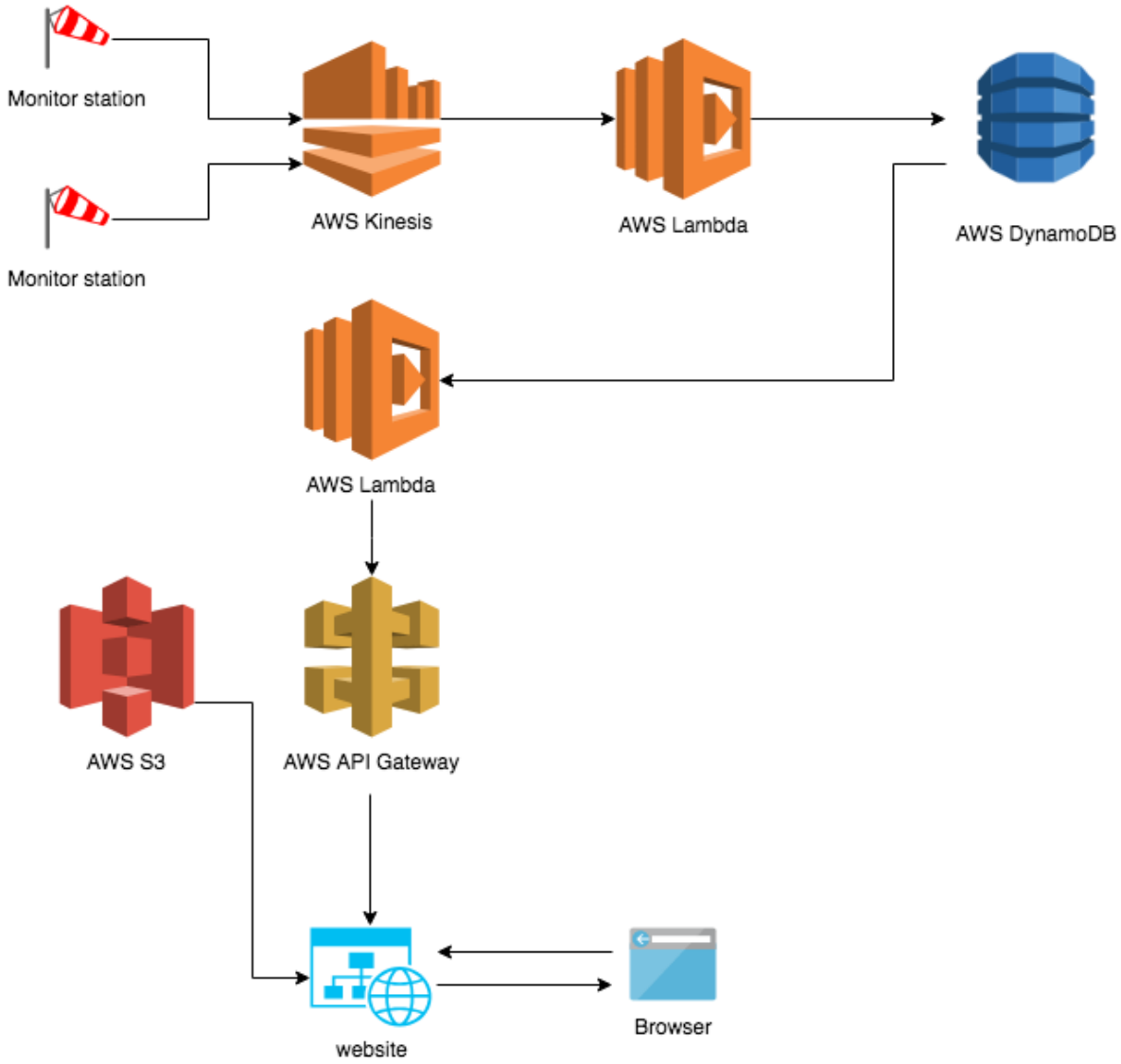
5V Relay

Gas detectors for CO,CO2,O3,SO2,NO,NO2



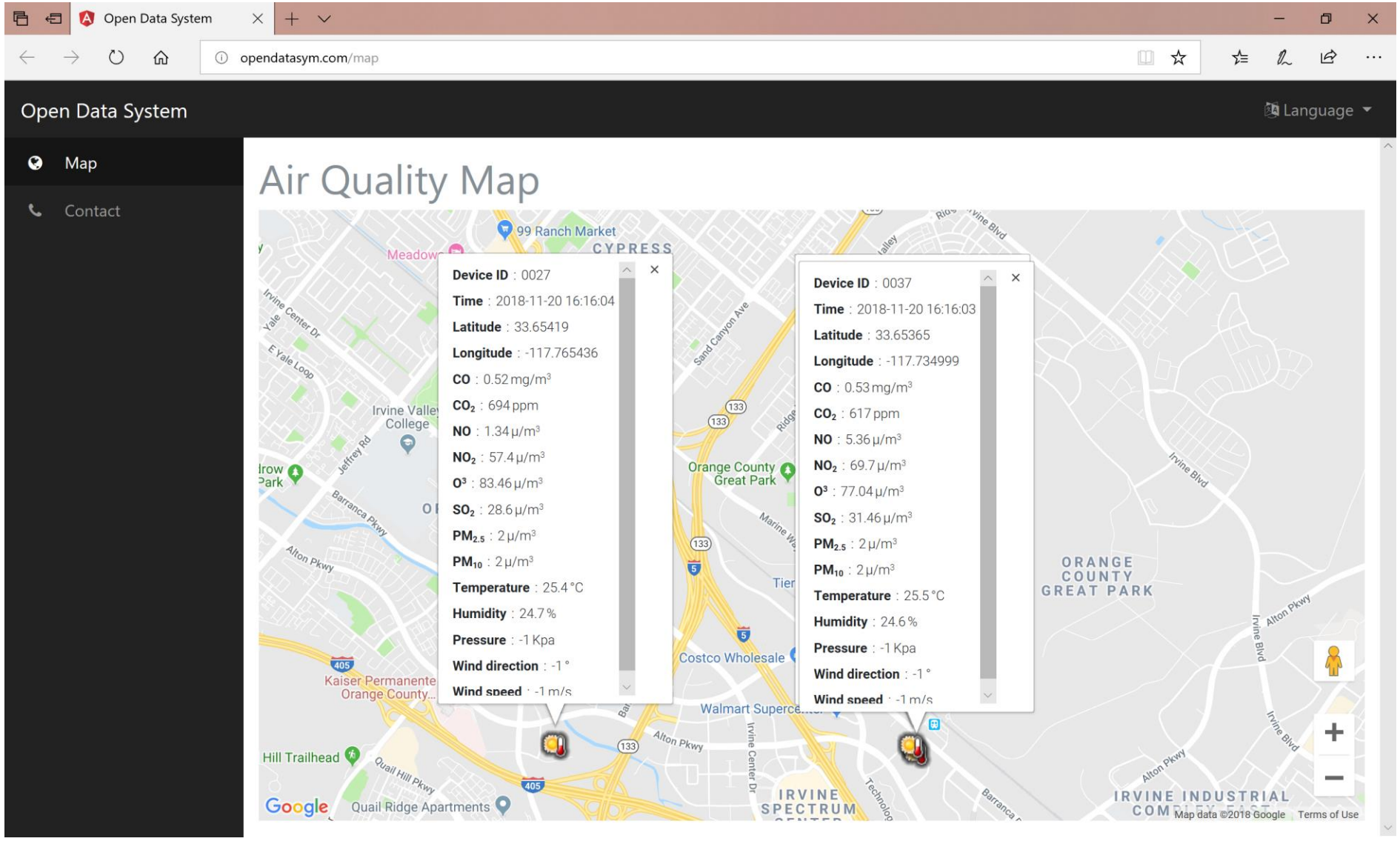
Database Architecture

- Data Collection
  - ❖ iAQBox air quality monitoring station
- Data Receiving and Processing
  - ❖ AWS Kinesis
  - ❖ AWS Lambda function
  - ❖ AWS DynamoDB
- Data Publishing
  - ❖ AWS Lambda function
  - ❖ AWS S3
  - ❖ AWS API gateway

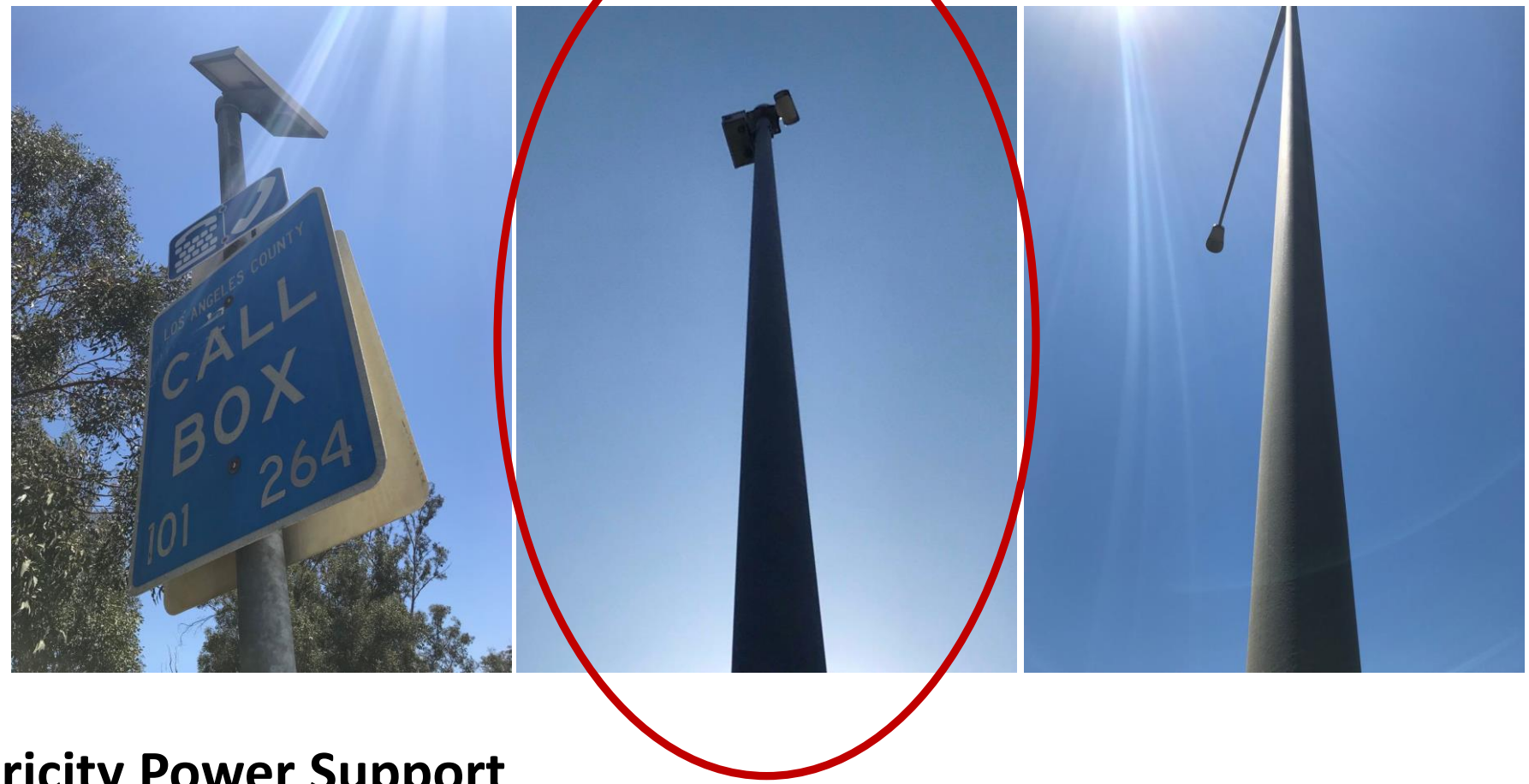


Preliminary Testing: http://opendatasym.com

Real-Time Data Online

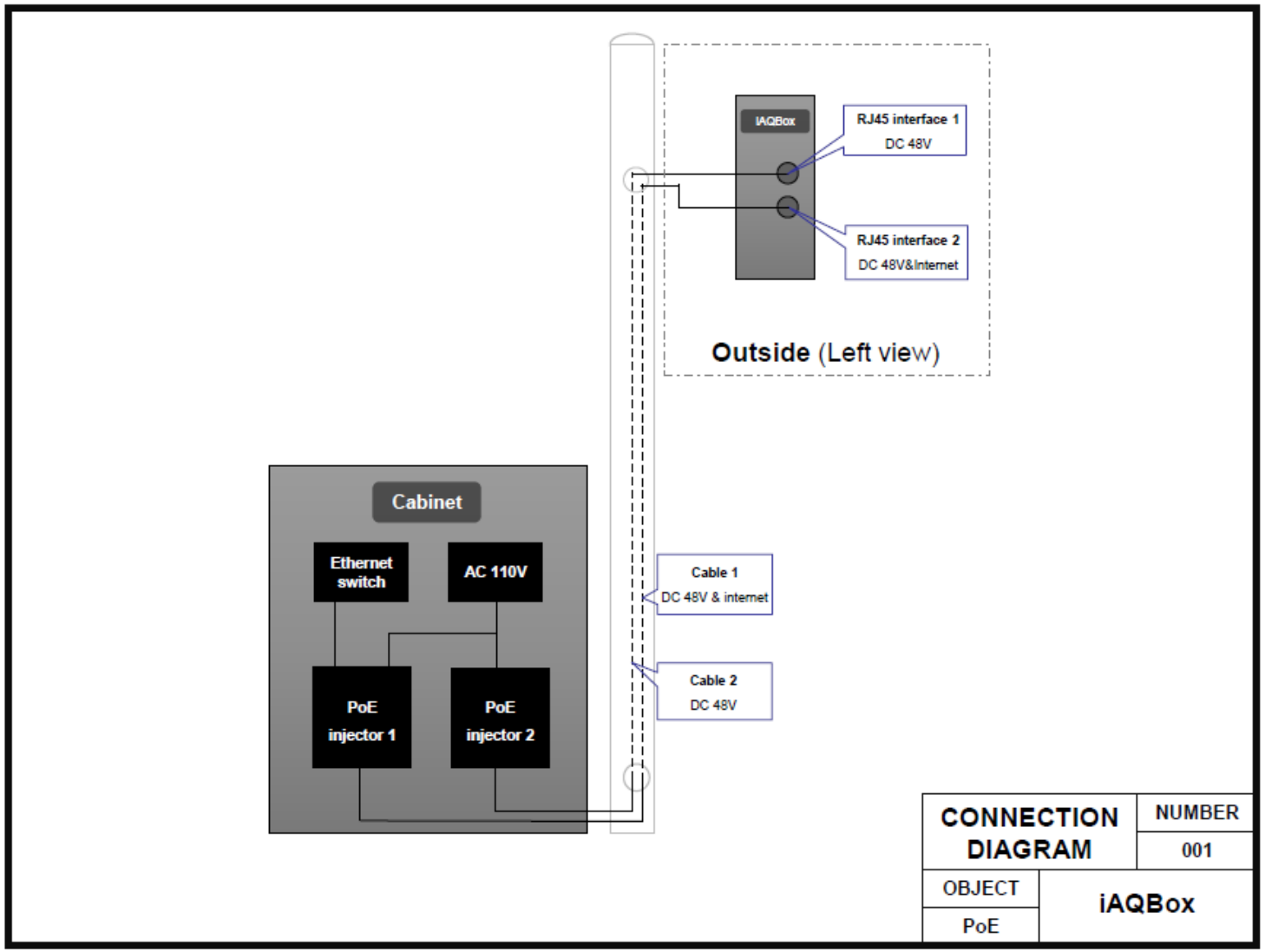


Next Step: Field Installation - Mounting iAQBox on CCTV Poles



- ✓**Electricity Power Support**
- ✓**Potential Ethernet Support**

Installation Diagram



Selected Two CCTV Poles for Field Installation

Thank You!
Questions?

Xinkai Wu
xinkaiwu@cpp.edu

Response Plans

Response Plan Generation

- **There has been quite a bit of discussion around response plan generation**
  - How is it done
  - What information is considered
  - How much improvement will they enable
  - Do they consider unreported capacity reductions
- **We are going to take a look at some of these items**

How are they generated - Planning

- **Routes**
  - Determine available routes with stakeholders
  - Determine which routes will be used for a given incident location
  - Move to Rules

How are they generated - Planning

- **Signals plan changes**
  - Determine signal plan timing changes that are acceptable
  - Determine likely demand increases during an incident
  - Run this through Synchro and generate updated timing plans
  - Run these plans + incident information through the Aimsun model
  - Do this based on historical time of day normal demand
  - Tune as needed
  - Review with stakeholders and update
  - Move to rules

How they are generated - Planning

- **CMS Messages**
  - Work with Caltrans on the messages
  - Review with stakeholders
  - Add to rules
- **DMS Messages**
  - Recommend to stakeholders
  - Update as requested
  - Add to rules
- **Ramp Metering**
  - We either set the ramps to green or we don't
  - Review with Caltrans
  - Add to rules

How they are generated - Planning

- **Unique Rules**
  - Identify unique Time of Day rules – Schools for example
  - Review with stakeholders
  - Move to rules
- **Time of Day, Day of Week Rules**
  - Determine when a route can be used even if a lane(s) are blocked
  - Based on historical data
  - Review with stakeholders
  - Move to rules

How they are generated - Planning

- **Time of Day - Determine which signal plan should be used**
  - Based on historical demands determine which plan will work best
  - Review with stakeholder
  - Move to Rules
- **Determine scoring criteria**
  - What criteria will be used for scoring
    - Proximity and length of route(s)
    - Queue length over one-hour horizon
    - Attractiveness: additional capacity provided to advantaged movements
    - Secondary impacts: potential for unsatisfied demand on disadvantaged movements

How they are executed

- **An incident is created and provided to the rules**
  - Location
  - Expected Duration
  - Lanes Blocked
  - Time and Date
- **We check the availability of**
  - Lanes
  - Assets
- **Rules use this information to:**
  - Choose the routes
  - Choose the signals
  - Choose the messages
- **Rules then rank these based on scoring criteria**

Rules, Estimation and Prediction

Rules, Estimation, and Prediction

- **A Rules Engine**
  - Executes rules and facts in order to develop a response plan.
  - The response plan contains routes and the settings for the control devices along the route.
  - For soft launch it will utilize the real time availability of control devices
- **An Estimation Engine**
  - Takes in data from freeway and arterial sensors and uses that data to create a picture of the traffic state of the overall corridor.
  - It fills in missing values and attempts to minimize the effect of bad data.
- **Predictions Provided by a Modeling Engine**
  - A micro model of the corridor that is used to provide a prediction of the effect of applying a particular response plan to an incident.
  - It uses the state provided by the estimation engine as its starting point and historical data (potentially scaled based on current state) for future demand.
- **Good Data → Estimation → Predictions**

Is modeling needed for the hard launch

DSS Type	Rules	Real Time Inventory	Real Time Traffic Data	Traffic Studies	Network Detail	Modeling	Accuracy
Rules	Yes	Yes	No	Simple	Rough	No	Good
Estimation	Yes	Yes	Yes	Medium	Medium	No	Better
Modeling	Yes	Yes	Yes	Detailed	Thorough	Yes	Best

Detecting unexpected changes in flow

- We explicitly determined early on that we were not doing incident detection. For example: A parked truck on an arterial.
- This can be difficult to do, especially on arterials
- That said, our system is at risk of providing inappropriate advice should there be an unreported incident. We do check for broken ITS elements.
- Mort has asked that we use our real time data to determine if the route is working correctly. This is akin to detecting an incident.
- In speaking with Anthony and Francois, they have said it is difficult to do well and will require data read over time. So even if we can determine there is a problem on the route it will take time.

Thank You
and
Next Meeting
(Suggest January 15th at Duarte)