Connected Corridors
Face-to-Face Meeting

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

All Requirements

Hardware and Software
- Technical Design
- Technical Requirements
- Service Level Agreements

Individual and Group
- Organizational Design
- Operational Roles and Responsibilities
- MOUs
# Subsystem schedules

<table>
<thead>
<tr>
<th>Personnel</th>
<th>2017</th>
<th>2018</th>
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<tbody>
<tr>
<td>Caltrans, PATH, PATH/Orgs</td>
<td>1st Qtr</td>
<td>2nd Qtr</td>
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<tr>
<td>Design</td>
<td>Assign</td>
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<thead>
<tr>
<th>Hardware and Construction</th>
<th>2017</th>
<th>2018</th>
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<tbody>
<tr>
<td>Caltrans, RIITS, PATH</td>
<td>Fiber Comm &amp; Cloud Projects</td>
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<td>Caltrans, Cities, County, Metro</td>
<td>Arterial Call For Projects</td>
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<td>Caltrans</td>
<td>Freeway Shopp</td>
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<tr>
<th>Core SubSystems</th>
<th>2017</th>
<th>2018</th>
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<tr>
<td>PATH, Caltrans</td>
<td>Cloud Infrastructure</td>
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<td>PATH, Caltrans</td>
<td>Data Hub</td>
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<td>PATH, Vendors</td>
<td>COTS (Purple Box)</td>
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<td>Design</td>
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<td>Contract</td>
<td>Select</td>
<td>Design</td>
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<thead>
<tr>
<th>New systems or Significant Upgrades</th>
<th>2017</th>
<th>2018</th>
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<tbody>
<tr>
<td>LAMetro</td>
<td>RIITS Video</td>
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<td>Caltrans</td>
<td>Caltrans Video</td>
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<td>Caltrans</td>
<td>PEMS</td>
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<td>Caltrans</td>
<td>ATMS</td>
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<td>Caltrans, Cities, County</td>
<td>Sign Control</td>
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<thead>
<tr>
<th>C2C Interfaces</th>
<th>2017</th>
<th>2018</th>
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<tr>
<td>PATH, Caltrans, Pasadena</td>
<td>McCain</td>
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<td>PATH, Caltrans, County</td>
<td>Kimley-Horn</td>
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<td>PATH, Caltrans, Arcadia</td>
<td>Transcore</td>
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<td>PATH, Caltrans</td>
<td>TSMSS</td>
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# Subsystem schedules

<table>
<thead>
<tr>
<th>Mostly Interfaces</th>
<th>2017</th>
<th>2018</th>
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<tr>
<td></td>
<td>1st Qtr</td>
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<tr>
<td>Caltrans, PATH</td>
<td>Closures</td>
<td>Deploy</td>
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<td>LAMetro, PATH</td>
<td>511</td>
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<td>LAMetro, PATH</td>
<td>RMTS/Transit</td>
<td>Design</td>
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<td>LAMetro, PATH, Caltrans</td>
<td>Environmental</td>
<td>Design</td>
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<td>Cities, County, PATH</td>
<td>Travel Time</td>
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<td>Data</td>
<td>PATH, Cities, County</td>
<td>City Data</td>
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<td>Caltrans' Data</td>
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<td>AMS/DSS</td>
<td>PATH</td>
<td>Estimation</td>
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<td>PATH</td>
<td>Simulation</td>
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<td>PATH</td>
<td>Prediction</td>
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<td>PATH</td>
<td>Rules Engine</td>
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<td>PATH, Caltrans, Cities, County</td>
<td>Rules</td>
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<td>PATH, Caltrans, Cities, County</td>
<td>Response Plans</td>
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<td>PATH Contracts</td>
<td>Caltrans</td>
<td>Data Hub</td>
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<tr>
<td></td>
<td>Caltrans</td>
<td>Next Contract</td>
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</table>
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

- 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)

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Caltrans D7</th>
<th>PATH</th>
<th>By When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finish adding the color-coding for the 4 roles identified by CT and update the appendix</td>
<td>Fred</td>
<td>3.17</td>
<td></td>
</tr>
<tr>
<td>Add a legend to explain the color-coding</td>
<td>Fred</td>
<td>3.17</td>
<td></td>
</tr>
<tr>
<td>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)</td>
<td>Rafael</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Further delegate CT tasks to new hires in D7</td>
<td>Rafael</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review initial job titles drafted by PATH and match job titles to CT personnel</td>
<td>Rafael</td>
<td>Lisa</td>
<td></td>
</tr>
<tr>
<td>Identify transition plan for the PATH (P) tasks (who will do the task at CT D7)</td>
<td>Rafael</td>
<td></td>
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</tr>
<tr>
<td>Determine when the tasks above would transition from PATH to D7 (Q/Yr)</td>
<td>Rafael</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Write summary of what the four D7 offices do (so that other CT districts can use similar office functions in their Corridor projects)</td>
<td>Rafael</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review the Stakeholder (S) tasks and determine if they will stay with Stakeholders for the duration of the project (or transition)</td>
<td>Lisa</td>
<td>3.17</td>
<td></td>
</tr>
<tr>
<td>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).</td>
<td>Rafael</td>
<td>Lisa</td>
<td></td>
</tr>
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</table>
Fiber and Cloud Communications

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

Caltrans Fiber – 2 Strands for Use by LA Region
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
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
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

CCTV Video Distribution
Concept Drawing
I-210 Connected Corridors

[Diagram of video distribution system involving Colbana District 7, Colbana Headquarters, RIITS, MS Azure, and Arcadia Public Works departments.]

Logos of various organizations, including Caltrans, Metro, Artesia, and others.
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
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
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

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

AM Peak
- GEH ≤ 5
- 5 < GEH ≤ 7.5
- 7.5 < GEH ≤ 10.0
- GEH ≥ 10.0
Example 2: Location of segments with high density (queuing)

AM Peak

Green: Low density
Orange: Medium density
Red: High density
Dark red: Queue across link
Simulation Model – Next Steps

- Incident locations currently considered
Simulation Model – Next Steps

- Design of traffic management responses for selected incidents

- Synchro Design
- Detour & Corridor
- Result Analysis
- Design Review / Manual adjustments
- Aimsun Simulation
Response Plans
I-210 East Reroutes
I-210 West Reroutes
DSS – Design Detail
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.
It’s the AMS team that crafts these Route Activation Sets, down to the level of the specific intersection and ramp meter timing plans:

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

Facts

- “Response-worthy” Incident
- Response Plan Elements
  - AND
  - Their Relationships / Dependencies
    - Route Activation Sets
    - Complementary Components
- Asset & Component Availability

Rules

- Eliminate routes that do not serve the incident (wrong direction, wrong location...)
- Eliminate routes, assets & components that are forbidden due to stakeholder business rules
  - AND
  - Eliminate Activation Sets on which they depend
- Eliminate assets and components that are off-line
  - AND
  - Eliminate Activation Sets on which they depend

Query for all routes for which there remain full, available activation sets & dependent components;
Build, export all remaining response plans for ranking step

Response Plans ready for Ranking
Thank You and Next Meeting