Connected Corridors
Face-to-Face Meeting

Tuesday, March 8th, 2016 – 1:30 – 3:30 pm
Caltrans D7 HQ
Agenda

- Introductions
- Quick Summary
- Metro Funded Project Details
- Requirements Update
- High Level Design Preview
- Response Plans Design
- Before and After Evaluation
- Action Items and Closing
Our Corridor: The I-210
Systems Engineering Next Steps

- **Systems Requirements** – What should the ICM system do
- **Design Documents** – How will the requirements be met
Quick Summary
Quick Summary

- **Outreach**
  - Connected Newsletter, meeting with MTC/D4/HQ, updating of web sites

- **Call for Projects**
  - Letter of No Prejudice Signed – Yes!
  - Continuing to refine the exact definition and cost of both ITS elements and software

- **Requirements**
  - Reviews and updates under way – Over 400 comments so far, more expected

- **Architecture and High Level Design**
  - Meetings to be setup with County and Caltrans HQ management

- **Response Plan Generation**
  - Working on corridor models and rules

- **Before/After Evaluation**
  - Moving to Fall time frame – Possible month long evaluation in order to capture an incident
Schedule

- **Infrastructure work on corridor**
  - SHOPP – To be completed by end of 2017
  - Call for Projects Arterial Improvements - To be completed by mid 2018

- **Need to update launch schedule as appropriate**

- **Possible phasing of launch – Analysis required**

- **Updated schedule presented once High Level Design starts**
## I-210 Pilot Schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Start Date</th>
<th>End Date</th>
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<tbody>
<tr>
<td>1. Project Initiation &amp; Management</td>
<td>10/1/13</td>
<td>9/28/18</td>
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<td>2. Outreach &amp; Communications</td>
<td>10/1/13</td>
<td>9/28/18</td>
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<td>3. Concept Exploration &amp; User Needs</td>
<td>11/1/13</td>
<td>12/26/14</td>
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<td>4. Corridor Preparation</td>
<td>12/2/13</td>
<td>9/30/16</td>
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<td>5a. AMS - Phase 1</td>
<td>1/6/14</td>
<td>5/29/15</td>
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<td>5b. AMS - Phase 2</td>
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<td>5c. AMS - Phase 3</td>
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<td>6. SEMP</td>
<td>12/29/14</td>
<td>6/26/15</td>
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<td>7. ConOps</td>
<td>9/12/14</td>
<td>5/20/15</td>
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<td>8a. System Requirements</td>
<td>4/23/15</td>
<td>3/30/16</td>
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<td>8b. Validation Plan</td>
<td>4/1/16</td>
<td>6/24/16</td>
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<td>9. Organizational Design</td>
<td>9/1/15</td>
<td>4/29/16</td>
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<td>10. Technical Design</td>
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<td>11. Component Development</td>
<td>3/10/16</td>
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<td>12. System Integration</td>
<td>4/6/16</td>
<td>7/24/17</td>
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<td>13. Institutional Deployment &amp; Operations</td>
<td>5/2/16</td>
<td>9/28/18</td>
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<td>15. Training</td>
<td>7/25/17</td>
<td>1/1/18</td>
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<tr>
<td>17. System Operations</td>
<td>10/9/17</td>
<td>9/28/18</td>
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<tr>
<td>19. Lessons Learned</td>
<td>5/2/17</td>
<td>9/28/18</td>
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**Notes:**
- **I-210 Pilot Schedule**
- **Start Date:** 10/1/13
  - **End Date:** 9/28/18
I-210 Arterial Call for Projects

- Letter of no prejudice approved – Very good

- 500K to be transferred to County for IEN upgrades and integration

- Caltrans managed Call for Projects funds involves two very different procurement paths
  - Items requiring standard A&E process
  - Service items involving software and other types of services
Items requiring standard A&E process

- Working with stakeholders to determine:
  - Current state of ITS elements
  - Desired upgrades
    - Agreeing on video where possible
  - Coming to agreement on small CMS signs at key intersections
    - Important because this is close to 2 Million of the funding
  - Costs of those elements

- Funding Agreement
  - Budget required by June as input to funding agreement
  - Funding Agreement expected to be approved by Sept of 2016

- Procurement
  - Project report will be completed by ?? for input to procurement
  - 6 months to post and award contracts —
    - Work should begin in 2017, Complete in 2018
Items requiring service contracts

- Working with stakeholders to determine
  - Software upgrades
  - Firmware upgrades
  - Costs of those upgrades

- Funding Agreement
  - Budget required by June as input to funding agreement
  - Funding Agreement expected to be approved by Sept of 2016

- Procurement
  - Requirements to be generated by ?? for input to procurement
  - 3 months to post and award contracts
    - Work should begin in 2017
    - Complete in early 2018
Opportunity for additional sensing

- Sensys and Verizon would like to work with Connected Corridors stakeholders to trial sensing technology in the 210 corridor
  - 24x7x365 archived and real time traffic volumes/counts, flow, and occupancy
  - Real-time color-coded congestion maps based on volume and/or occupancy
  - Detection system health monitoring and maintenance alerts

- Metro invited PATH to the discussion and facilitated several phone calls

- PATH identified several locations where sensing would be useful to the CC project, where the Call for Projects funding was not providing sensing and where the Sensys/Verizon technology may work
  - These are on Live Oak between Peck and Santa Anita

- We wanted to see if County and Arcadia would be interested in exploring this possibility
Requirements/Constraints Definition
Our System – People, Organizations, Hardware and Software
Requirements Document
Requirements - Current Status

- **Cities**
  - Arcadia – In person review, awaiting comments
  - Pasadena – In person review, awaiting comments
  - Duarte – Setting up meeting
  - Monrovia – Setting up meeting

- **Caltrans D7**
  - Maintenance – In review
  - Ramp Metering - In review
  - Signals – Reviewed and no comments
  - TMT & LCS – Comments received
  - TMC Operators – Comments received
  - TMC Support – Comments received
  - Office of ITS – Comments Received

- **Caltrans HQ**
  - Maintenance – Follow up planned
  - PEMS – Follow up planned
  - Signals – Follow up planned
  - TMT & LCS – Follow up planned
  - Office of Technology – Comments Received

- **Metro – Comments Received**

- **County – Comments Received**

- **CHP – Comments Received**

- **PIOs – Sent summary, awaiting comments**

- **Safety – Sent summary, awaiting comments**
Requirements

- We have received over 400 comments on the requirements.
- We have processed about 100 at this point
- We expect it will take two more weeks to process the comments
- Awaiting additional comments
Themes of the comments

- Not much disagreement with the basic requirements
  - Some questions on inclusion of non software requirements and of introductory material

- Concern about the ability to implement requirements

- Concern about interfacing of Caltrans systems to the ICM system

- Questions on Role of Transit and Parking

- Questions on Metrics

- Quite a few grammar and wording comments
Review Schedule

- **General Release – Jan 26th**
- **First Round Comments due – Feb 26th**
  - Summary and Generic
  - Detailed as desired
- **Updated Document – March 18th**
- **Second Round Comments due – April 15th**
  - All sections
- **Final Release – May 9th**
Caltrans Office of Technology
Office of Technology

- Continued participation with the DCCM DSS RSCS
- Coordination meetings with HQ IT
- Research on Data Hub
- TMS Pilot Corridor Reporting Coordination
High Level Design
High Level Design

- **Purpose - Map requirements to actual high level system components**
  - Defines the major components of the system
    - Organizations
    - Roles
    - Software Systems
    - Hardware Systems
  - Defines which components exist versus which ones need to be acquired
  - Defines high level data to be exchanged between components
  - Defines strategies for how components will communicate with each other
  - Defines who is responsible for each component
  - Guided by System Engineering Management Plan
High Level Design

- All Requirements
  - Hardware and Software
    - Technical Design
    - Technical Requirements
  - Individual and Group
    - Organizational Design
    - Operational Roles and Responsibilities
  - Service Level Agreements
  - MOUs
High Level Design – Manual and Automated

- **Design of Manual Components**
  - Organizational structures
  - Role definitions
  - Ownership/management of organizations and personnel
  - High level processes for communication and decision making

- **Automated Components**
  - Software
  - Hardware
  - Ownership
  - Communication, data management and process flows
High Level Design – Gap Analysis

- Map requirements to components
- Map components to owners who will provide the components
  - Existing
  - Existing requiring modifications
  - New
- Perform gap analysis
  - Components with no owners
  - Components with owners but no resources to actually provide components
SEMP Guidance

- ITS National and Regional Architectures

- Integration Approach
  - Horizontal integration - Specialized components responsible for enabling communication between other components
  - Corridor Manager and Data Functionality requirements

- Multi-Phase Integration

- Configuration Management
  - Creation of a Bill of Materials that contains all system components and is gradually made more granular as design and implementation occur
High-level Architecture
System Architecture Tools

- **Need a set of tools for:**
  - Capturing and documenting the system architecture and high level design
  - Providing a documentation trail
  - Future Update of the Regional Architecture
  - Corridor Staff Training

- **Would like the tools to be:**
  - An agreed upon standard
  - Widely used
  - Appropriate for our system needs
Proposed Development Tool: Turbo Architecture

- FHWA supported tool for Regional ITS Architecture development
- Can be used for project system architecture development
- Addresses all the considerations presented
- Flexible reporting and diagram capabilities allow all project agencies to benefit without the need for Turbo training
- Well supported:
  - In widespread use; well documented
  - Local FHWA office is supportive and offering Technical Assistance
Response Plans
Decision Support and Response Planning

- **Key Principle:** Decisions will be based on measurable, quality data

- **Decision Support needed for:**
  - Planning incident responses
  - Choosing incident responses in real time
  - Post incident analysis

- **Decision Support capabilities include:**
  - Data Quality Determination and Management – PEMS and Berkeley Tools
  - Signal Synchronization Tools – Synchro and possibly others like TranSync
  - Demand determination – Berkeley tools
  - Modeling – Aimsun
  - Rules Engines – Drools
  - Performance Metrics – PEMS and Berkeley tools
Response Plan Meetings

- Samson, Raj, Francois, Tom Choe, Tarek Hatata met to continue planning out response plans for review with stakeholders.

- Next Meeting on March 24th

- In three months we plan to be:
  - Running simulations
  - Running response plan scenarios
  - Running data quality analysis for freeway
  - Executing reasonably complex rules
  - Using rules to define simple response plans

- Plan to integrate with Samson’s “Human ICM”

- Plan to integrate with Tadeo’s Corridor Health Management
Models used as part of I-210 Pilot

Synchro Corridor Model
(8 AM, 5 PM)

Aimsun Corridor Model
(In Development)

Connected Corridors Model
(In Development)
Rule Types Identified in the Requirements

- Existence of an Incident
- Severity of an Incident
- Zone of Influence of an Incident
- Special Limitations
- Response Plan Components
- Building Response Plans from Components
- Selecting a Response Plan for Implementation
- Implementing a Response Plan
- Ending a response plan
We are using DROOLS

- Open source Business Rules Management System (BRMS) solution.
- It provides a core Business Rules Engine (BRE), and a web authoring and rules management application (Drools Workbench)
Rules Capture

Correlation key

Form

I-1210 direction (E,W)
W
I-210 Postmile
23.7
Current corridor demand level
Medium demand
Incident start time
03-03-2016 17:00:17
Incident duration (minutes)
90

Demand level (incident)
Medium demand

Duration (incident)
90

I-210 direction (incident)
W
I-210 Postmile (incident)
23.7
Incident start time (Incident)
03-03-2016 17:00:17
Severity rating:
2

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<th>Medium demand</th>
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Action Items and
Next Meeting Time
Thank You