Connected Corridors
(Virtual) Face-to-Face Meeting

Tuesday, April 28th, 2020
1:30 – 3:30 pm
via Zoom Video Conferencing
Zoom Tips

In the upper right hand corner, please make sure you are in the full screen view and the speaker view.
Zoom Tips

Once in full screen and speaker view, please “hide thumbnails” by selecting the – from the options list.
Zoom Tips

We will be turning off video and muting all participants during the presentation to conserve bandwidth.

Please unmute yourself and turn your video on to ask a question.
Agenda

- 1:30 - 2:00 – Introduction and Progress Summary
- 2:00 - 2:20 – Call for Projects Update
- 2:20 – 2:40 – Kapsch Update and Demo
- 2:40 – 3:15 – CC ICM System Demo
- 3:20 – 3:30 – Closing

Next Meeting - Tuesday June 9th

Note: Meeting location sequence Monrovia, Duarte, LA Metro, Caltrans TMC, County, Arcadia, Pasadena
Zhongren Wang, Office Chief of System Performance, Caltrans HQ

- Experienced Caltrans engineer with a demonstrated history of working in the civil engineering industry
- Skilled in traffic management, pavement management and other transportation-related areas
- 20 years with Caltrans
- Holds a Ph.D. degree in transportation engineering from University of Tennessee-Knoxville and authored numerous published papers
Joe is Retiring 07/01/2020 – a party at the first opportunity

- There will be a celebration when it is safe to do so.
  - Previously envisioned location: Imperial Western Brewing
    In Union Station
    800 N. Alameda St.
    Los Angeles, CA 90012
  - [https://www.imperialwestern.com](https://www.imperialwestern.com)
I-210 Pilot Implementation Project Progress Summary
Software in Integration and Production environments:

**Data Hub:**
- Data feeds for the following:
  - Ramp meters via ATMS*.
  - CMS signs via ATMS.
  - Freeway sensing via PeMS.
  - Freeway sensing via ATMS*.
  - Arcadia intersection signals via Transcor Transuite.
  - LA County intersection signals via KH Kits.
  - Caltrans intersection signals via TSMSS (Transcor Transuite).

**Corridor Management System:**
- Incident capture (integration environment only).
- Asset display (ramps, signals, signs).

**Test DSS:** integration environment only.

Note: * These still need to be verified in production.
Schedule – Till Launch (Page 1 of 2)

- Complete Call for Projects Procurement – Jan 2020
- ATMS with CC modifications deployed to Production – March 2020
- Major functions of the Test DSS work with production ATMS incident data – May 2020
- Data Hub configuration and deployment management functions Deployment/Release Hardening – May 2020
- Complete ATMS Modifications – August 2020
- Prediction (Aimsun) running in the cloud – July 2020
- Complete McCain Transparsity C2C interface – July 2020
- Loop Data Received by Data Hub from ATMS (currently from PeMS) – August 2020
- Rules Engine (Drools) running in the cloud – October 2020
- All ITS Elements Installed in Field – Q3-4 2020

(see CFP Status deck 20200415_SLD_I210ASI.MonthlyStatusMeeting_v1.pptx #7 “Data Communication Module and Video Detection Software Upgrade“)
Schedule – Till Launch (Page 2 of 2)

- Integrate Lane Closure System – September 2020
- All data (except signs) being received – November 2020 (bec. of CFP Package #7 ITS elements)
- Estimation running in the cloud – December 2020
- Performance Management System Available – December 2020
- Complete C2C Sign Interfaces – February 2021
- Complete Version 1.0 System Production Deployment/Release – February 2021
- System Operational Test and Validation – March-May 2021
- Before Study (SMG/Tom Choe, before-after study approach) – March to May 2021
- Launch Pilot – May 2021
Schedule — Pilot Launch to Pilot Completion

- Pilot Launch: May 2021
- Kapsch: May 2021 – September 2021
- Parsons: September 2021 – January 2022
- Interim Benefits Analysis: January 2022
- Telegra: January 2022 – May 2022
- After Study: March to April 2022
- Kapsch: June 2022 – September 2022
- Procurement of CMS system: August 2022
- Procurement of Aimsun: August 2022
- Pilot complete: September 2022
Planned Accomplishments for May 2020

- **Functions running real-time 24/7**
  - Capture production data from the freeway and arterials
  - Capture the production freeway incidents

- **Response Plan generation on demand**
  - Response plan generation using rules engine, estimation and prediction
  - Historical and real-time modes
  - Response plans to Corridor Management System - first round trip

- **Software development**
  - Create deployment mechanism for test DSS
  - Add automated tests for TSMSS, McCain Transparity
  - Additional ATMS testing, preparation for testing of ATMS changes
  - Containerize and cluster readers for improved resilience and scalability

- **AMS**
  - Data quality
  - Automate Scorecard generation
  - Incorporate new signal timing sheets into mode
Data Quality

- **Freeway - Core I-210 above 93% - Yes!**

<table>
<thead>
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<th>I-210 PM 25 - 43.25</th>
<th>East</th>
<th>West</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>93.1%</td>
<td>93.4%</td>
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</table>

- **Currently receiving data for:**
  - Ramps
  - CMS signs
  - TSMSS Signals
  - Arcadia Signals
  - LA County, Monrovia and Duarte Signals

- **Eagerly awaited:**
  - Pasadena
  - DMS Signs
Networking and Center to Center Connectivity

- **Caltrans C2C network connectivity for Data Readers**
  - System and firewall settings specially configured to allow TMDD “subscription update” dialogues
  - Ready to receive the incident information from production ATMS.

- **Arcadia**
  - RIITS firewall configuration updated to improve connectivity to Arcadia

- **Pasadena C2C**
  - Looking forward to testing the connectivity between the Data Hub and Pasadena’s servers in support of McCain Transparity application C2C

- **ICM User Secure System Access (via Kapsch application)**
  - County users received permission from IT to install RIITS VPN on workstations to access CMS/Purple Box
Networking and Center to Center Connectivity

- **Ongoing weekly meetings between RIITS and PATH**
  - D7 Caltrans are temporarily “available as needed”

- **Field asset monitoring**
  - Metro and Caltrans leading the effort *(Ed would you like to add?)*
  - Bi-weekly calls are being held
  - PATH providing ITS element location and type information
C2C Connectivity good since last Face-to-Face
C2C Interface Implementations - Status

Legend:
Green border – Done; Blue border – In Progress (thickness commensurate with progress)
Systems Integration

- **Pasadena**
  - McCain/Transparity C2C interface - Addressed issue preventing subscription messages (this is big!). Resuming testing

- **Dynamic Message Signs – Pasadena, LACO, Caltrans**
  - Beginning planning efforts for selected C2C interface architecture

- **Caltrans**
  - Required ATMS fixes identified. Meeting scheduled this week (4/30) to discuss plan forward

- **Environmental Stations with Air Quality Sensors and Open Data Systems (ODS)**
  - Meeting with Cal Poly Friday (5/1) to discuss access to response plans and data details
Systems Development

- **Production system initial stand-up**
  - Kapsch CMS deployed to production. Will deploy latest version (v3.1) this week
  - Currently receiving data from LACO, Arcadia, D7 ATMS, D7 TSMSS, PeMS

- **Improve release frequency – goal is new release to test every week**
  - Last major component (readers) being clustered and containerized

- **Updates**
  - Updated interface specification (v1.2) implemented within the system
  - Environment updated for Test DSS demonstrated today
TSMSS – Timing Plans Installed!!
Metro has asked System Metrics Group (SMG) to study the best way to perform a before and after study for the I-210.

SMG has provided an initial set of ideas:
- Broad look at performance
- What ITS elements/third party data is needed in order to effectively measure before and after performance

Tom, Steve, Ed would you like to add anything?
I-210 Connected Corridors
Face-to-Face Meeting

CALL FOR PROJECTS
Agenda

- I-210 CC Arterial Systems Improvement Project
  System Consulting Services - Overview

- Status of 9 procurement packages

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

STATUS OVERVIEW
## Project Objective

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

<table>
<thead>
<tr>
<th>#</th>
<th>Package Description</th>
<th>Contract #</th>
<th>Contract Status</th>
<th>Target</th>
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<tr>
<td>1</td>
<td>Bluetooth – Iteris Velocity</td>
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<td>Completed, Contract Closed</td>
<td>May 2019</td>
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<td>Bluetooth – BlueToad</td>
<td>07A4477</td>
<td>Installation &amp; Testing Phase</td>
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<td>3</td>
<td>New Controller Cabinets</td>
<td>07A4761</td>
<td>Material Review Phase</td>
<td>Q3-4,2020</td>
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<tr>
<td>4</td>
<td>Communication Upgrades</td>
<td>07A4479</td>
<td>Installation Completed Contract to be Closed</td>
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<td>Material Procurement Phase</td>
<td>Q3-4,2020</td>
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<td>Video Detection System</td>
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<td>Installation Completed Contract to be Closed</td>
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<tr>
<td>7</td>
<td>Data Communication Module and Video Detection Software Upgrade</td>
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<td>Material Review Phase</td>
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## Project Area

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Project Area (cont.)
UPDATE ON

PACKAGES 1-9
## Package Status – Pkg # 1

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<td>Bluetooth – Iteris</td>
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## Package Status – Pkg # 2

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<td>BlueToad</td>
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- **NTP:** 7/10/2018
- **Kick-off Meeting:** 7/30/2018
- **Submittal Approved:** 10/12/2018
- **Installation:**
  - LA County, Monrovia, Duarte: 10 locations done; LACo VM server configured on 5/15/19; working on LA Co <-> Pasadena VPN connection
  - Caltrans: 1 location without existing comms. Equipment delivered to LA County
  - Pasadena: field installation at 11 locations completed (3/24/2020); server installed at TMC, server to be configured
- **Site Testing:**
  - LA County: completed
  - Pasadena: to be scheduled
- **System Testing:**
  - To be scheduled
- **Expected to be completed:** June 2020 (90%)
Package Status – Pkg # 2

- **P2 - BlueToad Travel Time System – Comm. Architecture**

![Diagram of BlueToad Travel Time System](image_url)

- **Pasadena Field Network**
  - Field Device A
  - Field Device B

- **Pasadena TMC**
  - User
  - VM
    - PACMan Forwarding Server
  - Physical Server
    - Data Server (Current Windows) BlueArgus LINUX VM Server?
  - TCP-443

- **Pasadena DMZ**
  - RAW DATA 8010

- **LACO Field Network**
  - Field Device C
  - Field Device D

- **LACO TMC**
  - User
  - TCP-443
  - BlueArgus VM Server
  - RAW DATA 8010

- **3rd Party System**

**Future**

V1: 10/9/2019
V2: 2/19/2019
## Package Status – Pkg # 3

<table>
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<th>Pkg. #</th>
<th>Package Name</th>
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<th>Project Status</th>
</tr>
</thead>
</table>
| 3      | New Controller Cabinets 07A4761 Crosstown | • Advertised: 9/26/19  
• Awarded: 2/11/2020  
• NTP: 2/19/2020  
• Kick-off Meeting: 2/25/2020  
• On-going:  
  • 3/17/20: Material Submittal submitted  
  • 4/3 & 4/13/20: Stakeholders’ Review Comments returned to contractor  
  • On-going: Revising material submittal  
  • Expected to be completed: Q3-Q4, 2020 |

Risk: Staff & resource availability, logistic/travel/supply chain challenges associated with COVID-19 could impact schedule.  
McCain’s production facility in Tijuana is closed temporarily from 4/13/2020 to 5/4/2020 due to COVID-19.
### Package Status – Pkg # 4

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<td>4</td>
<td>Communication Upgrades</td>
<td>07A4479</td>
<td>• NTP: 7/13/2018&lt;br&gt;• Kick-off Meeting: 7/30/2018&lt;br&gt;• Submittal &amp; RFI Approved: 5/6/2019&lt;br&gt;• Equipment procured&lt;br&gt;• Installation of 35 locations: completed&lt;br&gt;• Testing &amp; Acceptance: completed (1/13/2020 &amp; 4/14/2020)&lt;br&gt;• Next steps: &lt;br&gt;  • Close all RFIs&lt;br&gt;  • Close the contract in May 2020&lt;br&gt;• Discussion&lt;br&gt;  • 5 locations in LA County – no communications yet (dropped 2 locations after 3/10/2020 F2F meeting)&lt;br&gt;  • Option 1: Waiting until RIITS network and L3 Switches are available – Q3-4, 2020&lt;br&gt;  • Option 2: Install 2 additional radios – cost estimate: $17,399.50, funding source?</td>
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## Package Status – Pkg # 5

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<th>Pkg. #</th>
<th>Package Name</th>
<th>Contract #</th>
<th>Project Status</th>
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</thead>
</table>
| 5      | Firmware/Timing Plan Updates/Controller Upgrades 07A4480 CPE, Inc | • NTP: 7/17/2018  
• Kick-off Meeting: 7/30/2018  
• Submittal Reviewed but Required hardware/firmware changed per Stakeholder Comment  
• Contractor revised price estimate ($124,971) lower than original amount ($171,600) – reviewed & approved by stakeholders  
• Material Submittals – approved  
• Materials Procurement – order placed, lead time 16-20 weeks  
• Installation Permits Application – in progress  
• Expected to be completed: Q3-Q4, 2020 |

**Risk:** Staff & resource availability, logistic/travel/supply chain challenges associated with COVID-19 could impact schedule.

McCain’s production facility in Tijuana is closed temporarily from 4/13/2020 to 5/4/2020 due to COVID-19.
## Package Status – Pkg # 6

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<td>6</td>
<td>Video Detection System</td>
<td>07A4481</td>
<td>• NTP: 7/10/18</td>
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<td>Traffic Loops</td>
<td>• Kick-off Meeting: 7/30/18</td>
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<td>Crackfilling, Inc</td>
<td>• 10/9/18: Conducted Site Survey</td>
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<td>• 10/18/18: Submittal approved</td>
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<td></td>
<td>• Installation: all 22 locations completed (Mar 2020)</td>
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<td></td>
<td></td>
<td>• Acceptance Testing: in process</td>
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<td></td>
<td>• As-built &amp; Test Reports: to be submitted</td>
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<td>• Expected to be completed: May 2020</td>
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## Package Status – Pkg # 7

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<th>Pkg. #</th>
<th>Package Name</th>
<th>Contract #</th>
<th>Project Status</th>
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</table>
| 7      | Data Communication Module and Video Detection Software Upgrade | 07A4755 Crosstown | • Advertised: 1/2/2020  
• Awarded: 2/11/2020  
• NTP: 2/19/2020  
• Kick-off Meeting: 2/25/2020  
• 3/17/20: Material Submittal submitted  
• 4/15/20: Stakeholder Comments Returned, Contractor is revising submittal, submitted RFI regarding 2 locations in Pasadena (change of work type)  
• Expected to be completed: Q3-Q4, 2020 |

- **30 Locations:**  
  - 4 locations in LA County  
  - 1 location in City of Duarte  
  - 3 locations in City of Monrovia  
  - 8 locations City of Pasadena  
  - 14 locations in City of Arcadia
# Package Status – Pkg # 8-1, 8-2, 8-3

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<th>Year</th>
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<th>2021</th>
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<td>Training</td>
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April 2021, Hard Launch of I-210 CC System (Est.)
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<th>Pkg. #</th>
<th>Package Name</th>
<th>Contract #</th>
<th>Project Status</th>
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</thead>
</table>
| 8-1    | Advanced Traveler Information Systems: DMS Procurement | 07A4792-3      | • Advertised: 10/25/19  
• Awarded: 12/2/ 2019  
• Kickoff meeting: 12/19/2019  
• Material Submittals & procurement: in progress  
• Expected to be completed: July 2020 |
### Package Status – Pkg # 8-1

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<tr>
<th>Item</th>
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<th>LACO</th>
<th>Pasadena</th>
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<td>DMS</td>
<td>21</td>
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<td>2</td>
<td>17</td>
<td>Approved. Ordered on 3/27/2020 (lead time: 16 wks) Estimated Delivery Date: Mid July 2020</td>
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<td>DMS Poles</td>
<td>19</td>
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<td>17</td>
<td>Approved. Ordered on 2/21/2020 (lead time: 18 wks) Est. Shipping Date: 6/12/2020 Est. Delivery Date: 7/1/2020</td>
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<td>Pull boxes</td>
<td>19</td>
<td>0</td>
<td>2</td>
<td>17</td>
<td>Stakeholder comments returned; Revised submittal (4/23/2020) being reviewed by stakeholders (lead time: 4 wks)</td>
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<td>Power &amp; Comm Cables</td>
<td>11,000 ft</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>Approved. to be ordered in May 2020 (lead time: 2 wks)</td>
</tr>
<tr>
<td>Radios</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>Approved. to be ordered in May 2020 (lead time: 3 wks)</td>
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<tr>
<td>Sign Control System with API</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Approved. Ordered on 3/27/2020 (Ledstar is preparing testing environment for Parsons team to test API &amp; C2C interface)</td>
</tr>
<tr>
<td>Servers</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>Stakeholder comments returned; updating submittal &amp; price quote (lead time: 1 wk)</td>
</tr>
</tbody>
</table>
Package Status – Pkg # 8-2

<table>
<thead>
<tr>
<th>Pkg. #</th>
<th>Package Name</th>
<th>Contract #</th>
<th>Project Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-2</td>
<td>Advanced Traveler Information Systems:</td>
<td>07A4794</td>
<td>• Advertised: 11/14/19&lt;br&gt;• Awarded: 1/3/2020&lt;br&gt;• Kickoff meeting: 1/14/2020</td>
</tr>
<tr>
<td></td>
<td>DMS Integration</td>
<td>Parsons</td>
<td>• Working on&lt;br&gt;  • Installation QC checklist: draft ready, waiting for confirmed material list&lt;br&gt;  • System Diagrams:&lt;br&gt;  • Overall - ready&lt;br&gt;  • LA County TMC – ready&lt;br&gt;  • Pasadena TMC – in stakeholder review&lt;br&gt;  • LARTMC – ready&lt;br&gt;  • C2C Interface Development:&lt;br&gt;  • Requirement &amp; Design Phase&lt;br&gt;  • D7 ATMS Modification:&lt;br&gt;  • Requirement &amp; Design Phase&lt;br&gt;  • Expected to be completed: Q1 2021</td>
</tr>
</tbody>
</table>
I-210 CC DMS Integration
Overall Communication Diagram (v1.0)
To be continuously refined
I-210 CC DMS Integration
Communication Diagram
LA County (v1.0)

To be continuously refined
I-210 CC DMS Integration Communication Diagram
Pasadena TMC (v0.4)

To be continuously refined
I-210 CC DMS Integration Communication Diagram
LARTMC (v0.2)

To be continuously refined
# Package Status – Pkg # 8-3

<table>
<thead>
<tr>
<th>Pkg. #</th>
<th>Package Name</th>
<th>Contract #</th>
<th>Project Status</th>
</tr>
</thead>
</table>
| 8-3    | Advanced Traveler Information Systems: DMS & static sign Installation | N/A to be handled by Caltrans, LAPDW, & Pasadena | 21 DMS Installation:  
  - LA County: start after Aug – Oct 2020  
  - Pasadena: expected July – Oct 2020  
Static Signs Materials:  
  - Ordered by Caltrans Maintenance Group: Jul. 2019  
  - Est. Ready in Jul 2020)  
Installation:  
  - to be handled by stakeholders (3 Caltrans, 2 Pasadena, 4 Arcadia, 1 Monrovia, 1 Duarte)  
  - Expected to be completed: Q3-Q4, 2020 |
# Package Status – Pkg # 9

<table>
<thead>
<tr>
<th>Pkg. #</th>
<th>Pkg. Description</th>
<th>Contract #</th>
<th>Project Status</th>
</tr>
</thead>
</table>
| 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  
  • Coordination w/ Foothill Transit & Pasadena Transit  
  • Coordination w/ PATH  
    • Data Specification  
    • Sample Response Plan  
    • Inventory of Road Network, Signal ID  
    • Reviewing & testing sample response plan (meeting on 5/1/2020)  
    • Coordination w/ Caltrans  
      • Communications Architecture - done  
• Expected to be completed: Q2-Q3 2020 |
Next Steps

- Package 2: Configure server, conduct site & system testing in Pasadena
- Package 3: Submit revised material submittal
- Package 4: Process remaining paperwork, close contract
- Package 5: Estimate material delivery & installation schedule
- Package 6: Submit as-built & test reports, close contract
- Package 7: Respond to RFI, Submit revised material submittal
- Package 8-1: Continue procurement; coordinate with 8-2
- Package 8-2: Finalize system diagrams, complete development requirements, start design
- Package 8-3: Track status
- Package 9: Support setting up comms & system testing
Thank You and Questions?
Kapsch Update and Demo
CC ICM System Overview

External Data Sources

- KITS, (LA County), (Duarte/Monrovia)
- Transparity, (Pasadena)
- TransSuite, (Arcadia)
- DMS Sign Vendors
- TSMSS
- ATMS Caltrans CMS, DMS and Ramp Meters

Interface for cities:
1. To see global view of entire corridor
2. To enter arterial events
3. To approve/disapprove response plans

Connected Corridors ICM Core System

- Decision Support System (DSS)
- Data Hub
- CMS (Kapsch) Local Agency Interface

Response Plan Execution in the Field

- KITS, (LA County), (Duarte/Monrovia)
- Transparity (Pasadena)
- TransSuite (Arcadia)
- DMS Sign Vendors
- TSMSS
- ATMS Caltrans CMS, DMS and Ramp Meters

Interface for Caltrans:
1. To enter freeway incidents
2. To approve/disapprove response plans

Other…
I-210 Integrated Corridor Management
Kapsch Update

Tim O’Leary
April 28, 2020
Good progress:

- Deployed latest EcoTrafiX V3.1 to CALTRANS AWS test environment
- Supports latest PATH TMDD V1.2
- Advanced link/lane closures - multiple roadway links; flexible lane closures
- Translate ATMS roadway links to Corridor roadway links
- EcoTrafiX ready to receive Response Plans from DSS
- Ready to deploy EcoTrafiX V3.1 to CALTRANS AWS production environment
EcoTrafiX Interface Status

**Interface**
- Integrated
- Ready to integrate
- In development

**TMCs**
- Arcadia
- LA County
- Others

**Diagram**
- Caltrans ATMS
  - Ramp Meter Commands
  - Voting
  - Response Plans
- EcoTrafiX (CMS)
  - Events
  - Ramp Meters
  - Detectors
  - DMS
  - Signal Controllers
  - Response Plans
- PATH HUB

**Legend**
- Green arrow: Integrated
- Dotted green arrow: Ready to integrate
- Grey arrow: In development
EcoTrafiX Status

Next Steps

- Receive Response Plans from PATH’s Decision Support System (DSS)
- Request TMCs execute device commands
- EcoTrafiX sends Response Plans to ATMS
EcoTrafiX Product Status

- EcoTrafiX V3.2 scheduled for June 2020

- In progress:
  - Improve roadway link incident creation
  - Waze integration
  - Regional Map device filters
  - Regional Map transparent layers
Corridor Management System Workflow

Traffic Management Centers
ATMS, Arcadia, LA County, Pasadena, etc.

Corridor Management System
EcoTrafiX (Arterial Events)
ATMS (Freeway Events)

Decision Support System
CALTRANS

Device Status (continuous)

Event
Response Plan Candidate

Vote
Response Plan Commands

Time
Repeat
Thank You!

Kapsch TrafficCom
4256 Hacienda Drive, Suite 100
Pleasanton, CA 94588
USA

www.kapsch.us

timothy.oleary@Kapsch.net

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CC ICM System Overview

External Data Sources

- KITS, (LA County), (Duarte/Monrovia)
- Transparity, (Pasadena)
- TransSuite, (Arcadia)
- DMS Sign Vendors
- TSMSS
- ATMS Caltrans CMS, DMS and Ramp Meters
- Other...

Connected Corridors ICM Core System

- Decision Support System (DSS)
- Data Hub

Interface for cities:
1. To see global view of entire corridor
2. To enter arterial events
3. To approve/disapprove response plans

Interface for Caltrans:
1. To enter freeway incidents
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Response Plan Execution in the Field

- KITS, (LA County), (Duarte/Monrovia)
- Transparity (Pasadena)
- TransSuite (Arcadia)
- DMS Sign Vendors
- TSMSS
- ATMS Caltrans CMS, DMS and Ramp Meters
- Other...
Accomplishments

- The Connected Corridors system works seamlessly with real existing systems
- This demonstration is working with the Caltrans Test ATMS and Kapsch EcoTrafiX
- The Connected Corridors Data Hub and Test DSS manage a great deal of complexity beneath the surface
- For a one-hour, three-lane incident in this demonstration, projected benefits include:
  - Arterial and freeway delay reduced by 507 veh-hours (-4.3%)
  - Freeway max queue reduced by 2.0 miles (-27.6%)
Today’s Demonstration Overview

- This is the map for what will be shown next

Reports freeway incident → Caltrans ATMS Interface → Kapsch → Data Hub → Response Plan Generator

- External traffic data on freeways and arterials → Kapsch

- Generates response plans and scorecards for review

- Evaluates response plan effectiveness

- Provides situational awareness

- Reports freeway incident

- External traffic data
For this demonstration Estimation runs in historical mode.

- Reports freeway incident
- Caltrans ATMS Interface
- Kapsch
- Data Hub
- Prediction
- Response Plan Generator
- Generates response plans and scorecards for review
- Evaluates response plan effectiveness
- Provides situational awareness

External traffic data on freeways and arterials …from March 5th
An ATMS incident triggers response plan generation.

Today's Demonstration Overview

- Data Hub
- Prediction
- Estimation
- Response Plan Generator
- Kapsch
- TMDD Interface
- Freeway Incident
- External traffic data on freeways and arterials

- Caltrans ATMS
Future goal: Show communication in other direction

- **Caltrans ATMS**
- **Kapsch**
- **Data Hub**
- **Response Plan Generator**
- **Prediction**
- **Estimation**

- **External traffic data on freeways and arterials**
- Evaluates response plan effectiveness
- Provides situational awareness
Behind the scenes...

An illustrated view of what happens inside of Prediction

This is a show and tell of the analysis that the Test DSS performs behind the scenes
Incident

- 3 right lanes blocked at Hill on I-210 WB at 2:00 PM for 1 hour
Potential Detours

- Maple Allen → Hill
- Maple San Gabriel → Hill
- Orange Grove Sierra Madre → Lake
- Orange Grove Michillinda → Lake
- San Gabriel
- Sierra Madre Villa
- Michillinda

- Maple San Gabriel → Hill - 120s Cycle
- Maple San Gabriel → Hill - 135s Cycle
Response Plans

- **Normal 2:00 PM signal operations**

- **Moderate response:** 120s Cycle - Aggressive: 135s Cycle
Decision Scorecard

One-hour simulation for decision support as run behind the scenes in the existing system
Flow Stats

- **Downstream On-Ramps**
- **Screenline:** East → West Flows
- **Upstream Off-Ramps**
- **Upstream off-ramp**
- **Downstream on-ramp**
Area Stats

- **VMT, VHT, Delay, Average Speed** within
  - Specific zone
  - Combination of zones covering incident congestion
Freeway / Detour Stats

- **VMT, VHT, Delay, Average Speed along**
  - Freeway segment from corridor end (I-605, SR-134) to incident
  - Detour(s) considered
Queue Stats

- **Average** and **max** 15-mph back of queue
  - Estimated only while incident is active

![Queue Stats Diagram]

<table>
<thead>
<tr>
<th>Time</th>
<th>TotalQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:05</td>
<td>0.05</td>
</tr>
<tr>
<td>14:10</td>
<td>0.05</td>
</tr>
<tr>
<td>14:15</td>
<td>0.75</td>
</tr>
<tr>
<td>14:20</td>
<td>1.37</td>
</tr>
<tr>
<td>14:25</td>
<td>1.78</td>
</tr>
<tr>
<td>14:30</td>
<td>2.15</td>
</tr>
<tr>
<td>14:35</td>
<td>2.58</td>
</tr>
<tr>
<td>14:40</td>
<td>3.14</td>
</tr>
<tr>
<td>14:45</td>
<td>3.72</td>
</tr>
<tr>
<td>14:50</td>
<td>4.69</td>
</tr>
<tr>
<td>14:55</td>
<td>5.10</td>
</tr>
<tr>
<td>15:00</td>
<td>3.82</td>
</tr>
</tbody>
</table>

Queue estimate over time

- **Time**
  - Average: 3.15 mi
  - Max: 5.10 mi
**Resulting Scorecard**

- **Conversion of all collected stats into a single evaluation score**

### Flow Counts

<table>
<thead>
<tr>
<th>Ramps</th>
<th>Screenline</th>
<th>Travel Times</th>
<th>Area Stats</th>
<th>Freeway Stats</th>
<th>Detour Stats</th>
<th>Freeway Queue</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incident</strong></td>
<td>I-210 WB @ Hill</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Response Plan Evaluated</strong></td>
<td>WB_Art_Maple_SanGabriel_Hill 120s</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Simulation Period</strong></td>
<td>14:00 - 15:00 min</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Evaluation Period</strong></td>
<td>14:15 - 15:15 min</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of Simulation Runs</strong></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Flow Counts

- **Upstream**:
  - Off-Ramps
  - On-Ramps
- **Downstream**:
  - Off-Ramps
  - On-Ramps
- **Fwy Queue**:
  - Flow
  - Delay
  - VMT
  - VHT
- **Detour Queue**:
  - Flow
  - Delay
  - VMT
  - VHT

### Travel Times

- **No-Response**:
  - 4.970 min
  - 2,882 veh
  - 0.862 veh
  - 40.0 veh
  - 179,669 veh
  - 7,780 veh
  - 45.70 veh
  - 23.09 veh
  - 77,254 veh
  - 2,189 veh
  - 1,834 veh
  - 27.22 veh
  - 2.909 veh
  - 401 veh
  - 18 veh
  - 7.25 veh
  - 3.72 veh
  - 6.05 veh

### Area Stats

- **Stats - Area Zone 2-5+5**:
  - Flow
  - Delay
  - VMT
  - VHT

### Freeway Stats

- **Stats - Fwy Mainline, HOV, Connectors**:
  - Flow
  - Delay
  - VMT
  - VHT

### Detour Stats

- **Stats - Detour #1**:
  - Flow
  - Delay
  - VMT
  - VHT

### Freeway Queue

- **Fwy Queue**:
  - Flow
  - Delay
  - VMT
  - VHT

### Productivity - Network

- **Sub-Score**: 650 veh
- **Travel Time Improvements**: -2.5 min
- **Network Performance**: 0.43 mph
- **Productivity - Fwy & Detours**: 2,149.2 veh-mi
- **Fwy Queue Improvements**: -0.70 veh

### Normalization Value

- **Normalization Value**: 1,000 veh/hr
- **Normalized Sub-Score**: 45 points
- **Normalization Value**: 5.0 min
- **Normalized Sub-Score**: 21 points

### Weight

- **Weight**: 0.200
- **Score**: 90.5 points
120s Cycle
Score: 82.3

135s Cycle
Score: 105.7

Recommends
135s Cycle Response
After-the-fact Incident Evaluation

Longer simulation for a full accounting of traffic benefits

This kind of retrospective evaluation can be performed after the incident to refine future operations
Evaluation Setup

- **Evaluation period**

- **Simulation replications**
  - *5 runs* for each scenario → Average results taken to reduce simulation stochastic variability
Simulation Results

- **2:15 PM – 10 min into incident**

  - No Response
    - End of Queue
  
  - Response
    - End of Queue
      - ~same
Simulation Results

- **2:30 PM – 25 min into incident / 10 min into response**

No Response

Response

No Response

Response

End of Queue

-0.3 mi
Simulation Results

- **2:45 PM – 40 min into incident / 25 min into response**

![Diagram showing impact of response on traffic density and queue length]

No Response:
- End of Queue: 1.0 mi

Response:
- End of Queue: -1.0 mi
Simulation Results

- 3:00 PM – 55 min into incident / 40 min into response
3:15 PM – 10 min after incident end / 55 min into response

- No Response
  - Back of congestion
- Response
  - Reduced congestion on arterials
Simulation Results

- 3:30 PM – 1hr 10 min into response

- No Response
  - Queue across interchange → Traffic exiting at Mt Olive
  - Normal 605 congestion

- Response
  - Reduced congestion on arterials
Simulation Results

- **3:45 PM – 5 min after response termination**

  - **No Response**
    - Queue across interchange \(\rightarrow\) Traffic exiting at Mt Olive
    - Normal 605 congestion

  - **Response**
    - Reduced congestion on arterials
Simulation Results

- 4:00 PM – Return to normal

No Response

Response

Normal 605 congestion

Density (veh/mi/lanes)
Highlights of Response Plan Benefits

- Upstream off-ramp flow increases by 428 vehicles (+12.7%)
- Freeway Travel time reduced by 4.8 minutes (-12.9%)
- System benefits including arterial and freeway:
  - VMT increases by 3418 veh-miles (+0.8%)
  - Delay reduced by 507 veh-hours (-4.3%)
- Freeway max queue reduced by 2.0 miles (-27.6%)
An ATMS incident triggers response plan generation

- Freeway Incident
- Caltrans ATMS
- TMDD Interface
- Kapsch
- Data Hub
- Response Plan Generator
- Prediction
- Estimation

External traffic data on freeways and arterials

Response Plan

Evaluates response plan effectiveness

Provides situational awareness
Accomplishments

- The Connected Corridors system works seamlessly with real existing systems
- This demonstration is working with the Caltrans Test ATMS and Kapsch EcoTrafIX
- The Connected Corridors Data Hub and Test DSS manage a great deal of complexity beneath the surface
- For a one-hour, three-lane incident in this demonstration, projected benefits include:
  - Arterial and freeway delay reduced by **507 veh-hours** (-4.3%)
  - Freeway max queue reduced by **2.0 miles** (-27.6%)
Data Quality
I-210 – Freeway Data Quality

- Despite recent outages core I-210 above 93%
  - SR-134 is under construction through May
  - I-605 lost about 6 days of data but coming back on line

<table>
<thead>
<tr>
<th>Freeway Section</th>
<th>Direction</th>
<th>Sensor Availability Percentage</th>
<th>Sensor Availability Target</th>
<th>Past Target Accomplishment</th>
<th>Date of Degradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-210 PM 22.6 - 25</td>
<td>East</td>
<td>81.4%</td>
<td>90%</td>
<td>na</td>
<td>3/7/2020</td>
</tr>
<tr>
<td></td>
<td>West</td>
<td>85.7%</td>
<td>90%</td>
<td>2/8/2020</td>
<td></td>
</tr>
<tr>
<td>I-210 PM 25 - 43.25</td>
<td>East</td>
<td>93.1%</td>
<td>90%</td>
<td>3/7/2020</td>
<td>4/4/2020</td>
</tr>
<tr>
<td></td>
<td>West</td>
<td>93.4%</td>
<td>90%</td>
<td>2/8/2020</td>
<td></td>
</tr>
<tr>
<td>SR-134 PM 11.4 - 13.5</td>
<td>East</td>
<td>50.7%</td>
<td>90%</td>
<td>3/21/2020</td>
<td>4/4/2020</td>
</tr>
<tr>
<td></td>
<td>West</td>
<td>54.2%</td>
<td>90%</td>
<td>3/21/2020</td>
<td>4/4/2020</td>
</tr>
<tr>
<td>I-605 PM 22.93 - 28</td>
<td>North</td>
<td>68.0%</td>
<td>90%</td>
<td>1/18/2020</td>
<td>4/4/2020</td>
</tr>
<tr>
<td></td>
<td>South</td>
<td>67.3%</td>
<td>90%</td>
<td>3/7/2020</td>
<td>3/14/2020</td>
</tr>
</tbody>
</table>
Determining trade-offs between latency, aggregation, and robustness

VDS availability for 2020-03-15

Red horizontal streak → no data from one VDS
Red vertical streak → no data for one timestamp

Data available
Not available
Real-time I-210 Freeway Data Quality

- Real-time feed for PeMS D7 data on I-210 corridor
  - Monitoring percentage of VDS missing every 30 minutes
  - Data drops are typically short-lived
  - Loss of data will affect estimation results
Arcadia Data Quality

- **Detector Inventory**
  - 543 detectors at 52 intersections
  - 264 of them (at 19 intersections) are on detour routes

- **Detector Health**
  - Overall detector health rate (on detour routes) in 70% range
Detector Inventory

- 123 detectors at 21 intersections
  - 54 from LACO, 43 from Monrovia, and 26 from Duarte
  - 107 of them (at 18 intersections) are connected to KITS and on detour routes

Data feed temporarily stopped due to improvements to data quality code

No update on detector health
Caltrans

- **Analysis of ATMS TMDD Messages**
  - Reviewed missing assets on westbound side of I-210 freeway
  - Parsons updated corridor database table
  - Collecting data for second review

- **Analysis of TSMSS data structures**
  - Bug reported in date-time format and fix sent by McCain today
  - In-depth analysis to continue

- **Conducted an initial Changeable Message Sign data evaluation from the production ATMS**
Stakeholder Progress
Response Plans – Stakeholder Progress

- **Pasadena (80 CC Intersections)**
  - All intersections are programmed with Connected Corridors flush plans

- **LA County (6 CC Intersections)**
  - All 6 timing sheets completed and ready for implementation

- **Monrovia and Duarte (17 CC Intersections)**
  - 3 revised signal plans completed along Huntington
Response Plans – Stakeholder Progress

- **Arcadia (19 CC Intersections)**
  - 17 intersections are programmed with Connected Corridors flush plans on Huntington, Foothill, and Santa Anita
  - 2 additional intersections awaiting installation of 2070 controllers on Colorado

- **Caltrans TSMSS (15 CC Intersections)**
  - All signal plans loaded onto controllers (!!!)
Next Steps
Next Steps

- Read real incident data from the production ATMS
- Generate and review the Response Plans based on this data
- Continue systems integration
- Refine plan for demonstration at 2020 ITS World Congress
Thank You
and
Next Meeting
(Suggest Tuesday June 9th @ Zoom)