

PARTNERS FOR ADVANCED TRANSPORTATION TECHNOLOGY
INSTITUTE OF TRANSPORTATION STUDIES
UNIVERSITY OF CALIFORNIA, BERKELEY

Connected Corridors: I-210 Pilot Integrated Corridor Management System

System Integration Subtasks

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1. INTRODUCTION

The overall requirements for the Connected Corridors system have been decomposed into the subsystems shown below. PATH is responsible for the design and implementation of components in blue, and Caltrans is responsible for the design and implementation of components in orange. PATH is also responsible for the overall integration of the components into a working system.

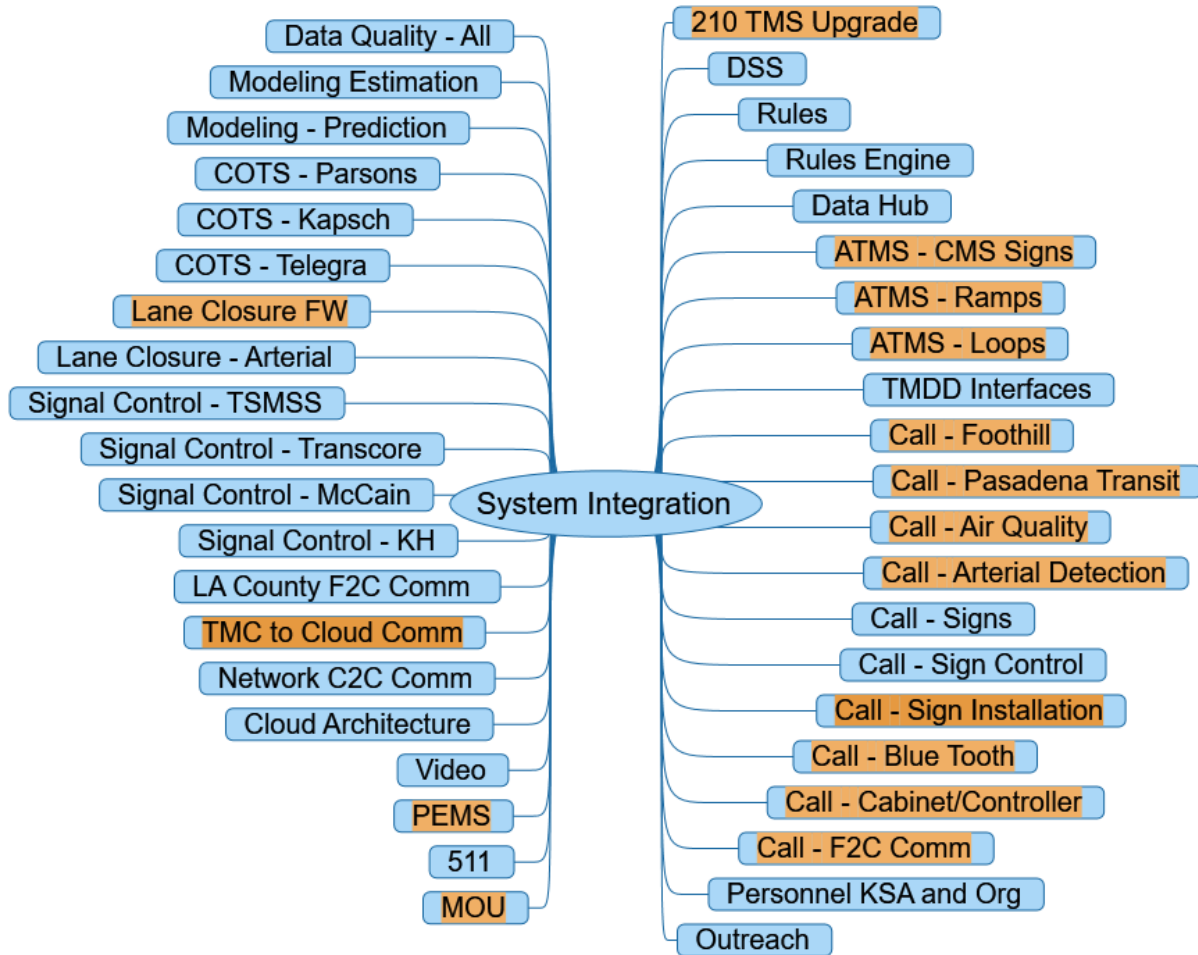


Figure 1: Subsystems to be integrated into the ICM system.
Blue = responsibility of PATH. **Orange** = responsibility of Caltrans.

Each item is further defined in this document. Additional information includes other stakeholders sharing responsibility for the implementation and success of the subsystem, plus notes and concerns.

1.1. DATA QUALITY

- a. Description – Ensure data quality goals are met
- b. Responsible organization – **PATH**
- c. PATH responsibilities – Work with stakeholders to help them understand how to gather data, measure data quality, and fix problems leading to poor data quality
- d. Other stakeholders – Caltrans, Pasadena, Arcadia, LA County, Monrovia, and Duarte
- e. Exclusions – PATH is not responsible for installing data measurement devices, collecting that data to a local TMC, or diagnosing and repairing hardware, software, or communication problems.
- f. Notes –
 - i. PATH can lead and facilitate this process but cannot perform it for stakeholders.
 - ii. PATH is planning to provide a small amount of consulting support to Pasadena, Arcadia, and LA County to assist with improving data quality. PATH is planning to hire Transcore, McCain, and Kimley-Horn to work with the stakeholders on this.
- g. Concerns and risks –
 - i. Maintaining high data quality is a cultural change for stakeholders. It may be difficult for them to provide focus, knowledge, resources, and funding.
 - ii. Data quality can be affected by many factors; some are not under the direct control of the personnel we work with.

1.2. MODELING – ESTIMATION

- a. Description – Utilize corridor data to determine the current state of traffic in the corridor. This state is used to launch predictions and provide information to stakeholders.
- b. Responsible organization – **PATH**
- c. PATH responsibilities –
 - i. Design
 - 1. Algorithms
 - 2. Software
 - 3. Interfaces
 - ii. Implementation
 - 1. Algorithms
 - 2. Software
 - 3. Interfaces
 - iii. Deploy
 - 1. In the Amazon cloud
 - iv. Test
 - 1. Develop the test harnesses and data
- d. Other stakeholders – None
- e. Exclusions – None
- f. Notes –

- i. Separate models will be used for freeways and arterials. The models being used for estimation were/are being developed as part of the research program and are not commercial products.
 - ii. The results will be displayed by the ICM subsystem.
 - g. Concerns and risks –
 - i. Estimation requires good data quality. Without good data, accurate estimation results cannot be guaranteed.
 - ii. Estimation is a new process in the ICM world, and there is some risk that the algorithms may not meet accuracy requirements.

1.3. MODELING – PREDICTION

- a. Description – Utilize corridor data, response plans, and estimation state to predict the future state of the corridor. Develop metrics based on these predictions. These metrics will be used in the ranking of response plans.
- b. Responsible organization – **PATH**
- c. PATH responsibilities –
 - i. Design
 - 1. Interfaces
 - ii. Implementation
 - 1. Calibration
 - 2. Interfaces
 - iii. Deploy
 - 1. In the Amazon cloud
 - iv. Test
 - 1. Develop the test harnesses and data
- d. Other stakeholders – None
- e. Exclusions – None
- f. Notes –
 - i. The TSS Aimsun model will be used for both freeway and arterial predictions.
 - ii. The results will be displayed by the ICM subsystem.
- g. Concerns and risks –
 - i. Aimsun does not currently run in the cloud. We are working with TSS to make this so.
 - ii. Prediction is difficult and based on good data.

1.4. COTS - PARSONS

- a. Description – Lead the integration of the Parsons I-NET system into the Connected Corridors effort
- b. Responsible organization – **PATH**
- c. PATH responsibilities –
 - i. Legal

- 1. Manage any of the legal agreements required
 - ii. Design
 - 1. Interfaces
 - iii. Implementation
 - 1. Interfaces
 - iv. Evaluation
 - 1. Lead the evaluation process
- d. Other stakeholders – None
- e. Exclusions –
 - a. PATH is not responsible for how well the COTS system functions.
 - b. Currently there is no backup plan per se in the risk register for the failure to deliver of all three COTS system vendors. Thoughts are that if this occurs then we will quickly work out a financial arrangement of some type with one of the vendors. Caltrans also indicated they may wish to have additional internal discussions on this topic
- f. Notes –
 - i. This is a challenging task as the vendors are not being paid and are expecting excellent support and working interfaces.
 - ii. The results will be displayed by the ICM subsystem.
- g. Concerns and risks –
 - i. The COTS vendor may choose to not participate.
 - ii. The COTS vendor may request assistance that PATH is unable to provide.

1.5. COTS - KAPSCH

- a. Description – Lead the integration of the Kapsch system into the Connected Corridors effort.
- b. Responsible organization – **PATH**
- c. PATH responsibilities –
 - i. Legal
 - 1. Manage any of the legal agreements required
 - ii. Design
 - 1. Interfaces
 - iii. Implementation
 - 1. Interfaces
 - iv. Evaluation
 - 1. Lead the evaluation process
- d. Other stakeholders – None
- e. Exclusions –
 - a. PATH is not responsible for how well the COTS system functions.
 - b. Currently there is no backup plan per se in the risk register for the failure to deliver of all three COTS system vendors. Thoughts are that if this occurs then we will quickly work out a financial arrangement of some type with one of the vendors. Caltrans also indicated they may wish to have additional internal discussions on this topic

- f. Notes –
 - i. This is a challenging task as the vendors are not being paid and are expecting excellent support and working interfaces.
 - ii. The results will be displayed by the ICM subsystem.
- g. Concerns and risks –
 - i. The COTS vendor may choose to not participate.

1.6. COTS - TELEGRA

- a. Description – Lead the integration of the Telegra system into the Connected Corridors effort.
- b. Responsible organization – **PATH**
- c. PATH responsibilities –
 - i. Legal
 - 1. Manage any of the legal agreements required
 - ii. Design
 - 1. Interfaces
 - iii. Implementation
 - 1. Interfaces
 - iv. Evaluation
 - 1. Lead the evaluation process
- d. Other stakeholders – None
- e. Exclusions –
 - a. PATH is not responsible for how well the COTS system functions.
 - b. Currently there is no backup plan per se in the risk register for the failure to deliver of all three COTS system vendors. Thoughts are that if this occurs then we will quickly work out a financial arrangement of some type with one of the vendors. Caltrans also indicated they may wish to have additional internal discussions on this topic
- f. Notes –
 - i. This is a challenging task as the vendors are not being paid and are expecting excellent support and working interfaces.
 - ii. The results will be displayed by the ICM subsystem.
- g. Concerns and risks –
 - i. The COTS vendor may choose to not participate.
 - ii. The COTS vendor may request assistance that PATH is unable to provide.

1.7. LANE CLOSURE - FREEWAY

- a. Description – Provide a lane closure system for Caltrans
- b. Responsible organization – **Caltrans HQ Ops**
- c. Caltrans responsibilities –

- i. Caltrans currently has a lane closure system already in place. This lane closure system will be used for the I-210.
 - ii. Caltrans employees should know how to use this system and be able to use it.
- d. Other stakeholders –
 - i. PATH -
 - 1. Data and Communication interfaces from lane closure to data hub
 - 2. Communication interfaces to stakeholders
- e. Exclusions – None
- f. Notes – None
- g. Concerns and risks -
 - i. The lane closure system does not always accurately describe the actual lane closure state of the freeway.

1.8. LANE CLOSURE - ARTERIAL

- a. Description – Provide a lane closure system for stakeholders other than Caltrans. This lane closure system must support arterials.
- b. Responsible organization – **Caltrans HQ Ops**
- c. Caltrans responsibilities –
 - i. Caltrans currently has a lane closure system already in place. This lane closure system will be used for the I-210.
- d. Caltrans employees should be able to use the system in a “read only” mode. Caltrans personnel are not responsible for entering or verifying arterial lane closure information
Other stakeholders –
 - i. PATH -
 - 1. Data and Communication interfaces from lane closure to data hub
 - 2. Communication interfaces to stakeholders
 - ii. Cities and County
 - 1. The Cities and County are responsible for entering, maintaining and removing lane closure entries.
- e. Exclusions – PATH is not responsible for how well the Caltrans provided system functions. PATH does not plan to actively police these closures but will review on a regular basis with the stakeholders. If there are problems during an incident then the level of effort focused on ensuring accuracy will be increased
- f. Notes –
 - i. This system was designed for use by the high-speed rail system.
- g. Concerns and risks –
 - i. The system may not work to the degree acceptable to the stakeholders.
 - ii. Stakeholders may not be able to develop processes to use it.

1.9. SIGNAL CONTROL C2C INTERFACE – TSMSS BY TRANSORE FOR CALTRANS

- a. Description – Develop, install, and test a C2C interface for use between TSMSS and the CC data hub
- b. Responsible organization – **PATH**
- c. PATH responsibilities – This will be subcontracted to Transcore for implementation, but PATH is responsible for ensuring the results meet requirements.
 - i. Legal
 - 1. Manage any of the legal agreements required
 - ii. Project Management
 - 1. Manage Transcore’s subcontract
 - iii. Design
 - 1. TMDD Interfaces
 - iv. Implementation
 - 1. Interface to data hub
 - v. Evaluation
 - 1. Lead the evaluation process
- d. Other stakeholders –
 - i. Caltrans D7 with Support of HQ Ops
 - 1. Work with Transcore and PATH to install, configure, and test the functionality. Provide needed access to servers, communication paths, and personnel.
- e. Exclusions – Caltrans HQ and D7 employees must permit Transcore to install the system in the TMC and permit the exchange of information between the new functionality and the data hub, DSS and ICM subsystem.
- f. Notes –
 - i. We are building a common set of TMDD interface requirements for this.
- g. Concerns and risks –
 - i. Standard contracting risks.

1.10. SIGNAL CONTROL C2C INTERFACE – TRANSUITE BY TRANSORE FOR ARCADIA

- a. Description – Install and test a C2C interface for use between Transsuite and the CC data hub
- b. Responsible organization – **PATH**
- c. PATH responsibilities – This will be subcontracted to Transcore for implementation, but PATH is responsible for ensuring the results meet requirements.
 - i. Legal
 - 1. Manage any of the legal agreements required
 - ii. Project Management
 - 1. Manage Transcore’s subcontract
 - iii. Design
 - 1. TMDD Interfaces

- iv. Implementation
 - 1. Interface to data hub
- v. Evaluation
 - 1. Lead the evaluation process
- d. Other stakeholders –
 - i. Arcadia
 - 1. Work with Transcore and PATH to install, configure, and test the functionality. Provide needed access to servers, communication paths, and personnel.
- e. Exclusions – Arcadia employees must permit Transcore to install the system in the TMC and permit the exchange of information between the new functionality and the data hub, DSS and ICM subsystem.
- f. Notes –
 - i. The actual interface will be developed as part of the TSMSS interface for Caltrans.
 - ii. We are building a common set of TMDD interface requirements for this.
- g. Concerns and risks –
 - i. Standard contracting risks.

1.11. SIGNAL CONTROL C2C INTERFACE – TRANSPARITY BY MCCAIN FOR PASADENA

- a. Description – Develop, install, and test a C2C interface for use between Transparity and the CC data hub
- b. Responsible organization – **PATH**
- c. PATH responsibilities – This will be subcontracted to McCain for implementation, but PATH is responsible for ensuring the results meet requirements.
 - i. Legal
 - 1. Manage any of the legal agreements required
 - ii. Project Management
 - 1. Manage McCain’s subcontract
 - iii. Design
 - 1. TMDD Interfaces
 - iv. Implementation
 - 1. Interface to data hub
 - v. Evaluation
 - 1. Lead the evaluation process
- d. Other stakeholders –
 - vi. Pasadena
 - 1. Work with McCain and PATH to install, configure, and test the functionality. Provide needed access to servers, communication paths and personnel.
- e. Exclusions – Pasadena employees must permit McCain to install the system in the TMC and permit the exchange of information between the new functionality and the data hub, DSS and ICM subsystem.
- f. Notes –

- i. We are building a common set of TMDD interface requirements for this.
- g. Concerns and risks –
 - i. Standard contracting risks.

1.12. SIGNAL CONTROL C2C INTERFACE – KITS BY KIMLEY-HORN FOR LA COUNTY, MONROVIA, AND DUARTE

- a. Description – Develop, install, and test a C2C interface for use between KITS and the CC data hub.
- b. Responsible organization – **PATH**
- c. PATH responsibilities – This will be subcontracted to Kimley-Horn for implementation, but PATH is responsible for ensuring the results meet requirements.
 - i. Legal
 - 1. Manage any of the legal agreements required
 - ii. Project Management
 - 1. Manage Kimley-Horn subcontract
 - iii. Design
 - 1. TMDD Interfaces
 - iv. Implementation
 - 1. Interface to data hub
 - v. Evaluation
 - 1. Lead the evaluation process
- d. Other stakeholders –
 - i. LA County
 - 1. Work with Kimley-Horn and PATH to install, configure, and test the functionality. Provide needed access to servers, communication paths and personnel.
- e. Exclusions – LA County must permit Kimley-Horn to install the system in the TMC and permit the exchange of information between the new functionality and the data hub, DSS and ICM subsystem.
- f. Notes –
 - i. We are building a common set of TMDD interface requirements for this.
- g. Concerns and risks –
 - i. Standard contracting risks

1.13. LA COUNTY FIELD-TO-CENTER COMMUNICATION

- a. Description – Design and facilitate the installation of several physical connections from wireless devices servicing LA County, Monrovia, and Duarte field equipment to Caltrans fiber. Ensure the logical connections permit data communication from the field devices to the LA County TMC.
- b. Responsible organization – **PATH**

- c. PATH responsibilities – Manage the process, hire appropriate subcontractors, and ensure success.
- d. Other stakeholders –
 - i. RIITS (Metro) is a full partner in this effort, and it cannot happen without their purchasing, configuring, and managing of the equipment.
 - ii. LA County – LA County is an owner in this, and it cannot happen without their support and network information.
 - iii. Monrovia and Duarte – They need to be involved if LA County will be operating the traffic signal systems for them. There must be an MOU or some sort of agreement between them for this operation to take place.
- e. Exclusions –
 - a. PATH cannot succeed without RIITS and LA County support.
 - b. Any work Caltrans is involved in is in the field and there is no Caltrans scope of work on LA County’s trunk communication to their TMC.
- f. Notes –
 - i. RIITS will provide the hardware, maintenance, and management of the required equipment.
 - ii. Caltrans D7 must provide access to their cabinets for equipment.
- g. Concerns and risks –
 - i. RIITS purchasing process
 - ii. Caltrans D7 providing access to cabinets
 - iii. Possible technical issues of signal interference raised by Caltrans

1.14. NETWORK CENTER-TO-CENTER COMMUNICATION

- a. Description – Design and facilitate data and video communication from Pasadena, Arcadia, and LA County to Caltrans TMC/Amazon cloud. Design and oversee the deployment of both a short-term implementation meeting the I-210 pilot schedule and a long-term implementation that will meet the regional communication goals. The long-term implementation will use D7 fiber controlled by RIITS.
- b. Responsible organization – **PATH**
- c. PATH responsibilities – Manage the process, hire appropriate subcontractors, and ensure success.
- d. Other stakeholders –
 - i. RIITS (Metro) is a full partner in this effort, and it cannot happen without their purchasing, configuring, and managing of the equipment.
 - ii. Caltrans D7 is a full partner in this, and it cannot happen without their support and network information.
 - iii. LA County – LA County is a partner in this, and it cannot happen without their support and network information.
 - iv. Pasadena - Pasadena is a partner in this, and it cannot happen without their support and network information.
 - v. Arcadia is a partner in this, and it cannot happen without their support and network information.

- e. Exclusions – PATH cannot succeed without the support of all stakeholders, as this deliverable involves physical and logical changes to their IT systems. In particular, RIITS is providing consulting, hardware, configuration, operation, and maintenance. Caltrans is providing the fiber.
- f. Notes -
 - i. RIITS will provide the hardware, maintenance, and management of the required equipment.
 - ii. Caltrans D7 must provide access to their fiber and facilitate all necessary permit and Maintenance agreements, access through their firewalls, and communication to the Amazon cloud.
- g. Concerns and risks –
 - i. RIITS purchasing process
 - ii. Caltrans D7 providing access through firewall
 - iii. The basic requirements can be met in several ways; however, the stakeholders are interested in improving the regional communication network as part of the CC program.

1.15. TMC-TO-CLOUD COMMUNICATIONS

- a. Description – Ensure communications exist between the TMC and the Amazon cloud
- b. Responsible organization – **Caltrans D7**
- c. Caltrans responsibilities – With assistance from HQ Ops, design, procure, install, configure, test, and maintain a network connection from the D7 Caltrans TMC to the Amazon cloud. Ensure CC stakeholder information passes back and forth over this connection.
- d. Other stakeholders
 - i. PATH – Assist with design and configuring of connection on the Amazon cloud end. Assist with testing.
- e. Exclusions – None
- f. Notes – None
- g. Concerns and risks
 - i. Caltrans D7 procurement
 - ii. Caltrans HQ and D7 must work together effectively on this.

1.16. AMAZON CLOUD ARCHITECTURE

- a. Description – Design and implement the proper communication, process segregation, and security for the functions being implemented in the Amazon cloud.
- b. Responsible organization – **PATH**
- c. PATH responsibilities – Manage, design, implement, and test
- d. Other stakeholders –
 - i. Caltrans HQ Ops and D7 are full partners in this, as the system will be transferred to Caltrans HQ Ops once the pilot is completed.
- e. Exclusions – None

- f. Notes – None
- g. Concerns and risks - None

1.17. VIDEO

- a. Description – Design and facilitate the installation of both video distribution and Pan, Tilt, Zoom (PTZ) functionality for LA County, Arcadia, and Pasadena (not Caltrans). Design and facilitate integration of Wowza servers from Caltrans with the overall regional video system. Work with RIITS to ensure video distribution.
- b. Responsible organization – **PATH**
- c. PATH responsibilities – Manage the process, hire appropriate subcontractors, and ensure success.
- d. Other stakeholders –
 - i. RIITS (Metro) is a full partner in this effort, and it cannot happen without their purchasing, configuring, installing and managing of the equipment.
 - ii. Caltrans D7 is a full partner in this, and it cannot happen without their purchasing, configuring, and managing of their equipment.
 - iii. LA County – LA County is a partner in this, and it cannot happen without their providing licenses.
 - iv. Pasadena - Pasadena is a partner in this, and it cannot happen without their support and network information.
 - v. Arcadia is a partner in this, and it cannot happen without their support and network information.
- e. Exclusions – PATH cannot succeed without the support of all stakeholders, as this deliverable involves physical and logical changes to their IT systems. In particular, RIITS is providing consulting, hardware, configuration, operation, and maintenance. Caltrans is providing their own servers. LA County will be providing the licenses.
- f. Notes –
 - i. RIITS will provide the hardware, maintenance, and management of the required equipment.
 - ii. RIITS will provide funding for Parsons to install their video servers
 - iii. Caltrans D7 must purchase, install, configure, and provide for network communication of Wowza video servers.
 - iv. LA County will provide the licenses for the Parsons server
- g. Concerns and risks
 - i. RIITS purchasing process
 - ii. Caltrans purchasing process
 - iii. LA County purchasing process
 - iv. The basic requirements can be met without PTZ, but the stakeholders desire it and thus we have added it to the design. This goal may not be able to be accomplished in time for launch.

1.18. PEMS

- a. Description – Ensure PeMS is updated to meet CC requirements for the I-210
- b. Responsible organization – **Caltrans HQ Ops**
- c. Caltrans responsibilities – Likely through subcontractors, manage, design, implement, and test the system
- d. Other stakeholders –
 - i. PATH – Responsible for defining the interfaces and testing out the overall system integration once completed
- e. Exclusions – None
- f. Notes – None
- g. Concerns and risks –
 - i. Caltrans procurement
 - ii. Schedule will require phasing of deliverables.

1.19. TRAVELLER INFORMATION - 511

- a. Description – Provide information to 511 for dissemination during an incident
- b. Responsible organization – **PATH**
- c. PATH responsibilities – Ensure messages are sent via RIITS to 511
- d. Other stakeholders –
 - i. RIITS (Metro) is the data pathway, and RIITS must provide APIs for us to use in passing data to 511.
 - ii. 511– 511 must agree to accept and display the data.
- e. Exclusions – PATH cannot succeed without RIITS and 511 support.
- f. Notes –
 - i. RIITS is currently working to develop the software functions needed.
 - ii. 511 will develop the needed software.
- g. Concerns and risks –
 - i. RIITS software development process
 - ii. 511 software development process

1.20. MOU – MEMORANDUM OF UNDERSTANDING

- a. Description – Ensure an appropriate MOU is signed by stakeholders
- b. Responsible organization – **Caltrans**
- c. Caltrans responsibilities – Develop, present, market, and ensure the signing of an MOU with all stakeholders
- d. Other stakeholders –
 - i. PATH – Assist as needed with MOU process
 - ii. Pasadena, Arcadia, LA County, Monrovia, Duarte – These are the principal signers of the MOU.

- e. Exclusions – Caltrans cannot be held responsible if stakeholders simply will not sign the MOU despite significant effort and outreach.
- f. Notes –
 - i. MOU should address
 - 1. Equipment
 - 2. System availability
 - 3. Agreement to let a central system control local ITS elements
 - 4. Ongoing participation in the ICM process
 - 5. Indemnification issues
- g. Concerns and risks –
 - i. MOUs are politically and legally sensitive, and it may be difficult to obtain agreement and signatures.

1.21. 210 TMS UPGRADE

- a. Description – Upgrade the ITS and communication elements on the corridor. Install demarcation point with dedicated fiber optic cable assignment for RIITS network.
- b. .
- c. Responsible organization – **Caltrans D7**
- d. Caltrans D7 responsibilities – Through subcontractors, manage, design, implement, and test the upgrades
- e. Other stakeholders – None
- f. Exclusions – None
- g. Notes – Two fiber strands will be provided from Caltrans fiber trunk for RIITS.
- h. Concerns and risks –
 - i. Contractor permitting us to use improvements before end of contract

1.22. DSS – DECISION SUPPORT SYSTEM

- a. Description – Provide recommended response plans to alleviate incident congestion
- b. Responsible organization - **PATH**
- c. PATH responsibilities –
 - i. Design
 - 1. Software
 - 2. Interfaces
 - ii. Implementation
 - 1. Software
 - 2. Interfaces
 - iii. Deploy
 - 1. In the Amazon cloud
 - iv. Test
 - 1. Develop the test harnesses and data

- d. Other stakeholders – None
- e. Exclusions – None
- f. Notes –
 - i. The DSS will use an open source rules engine – DROOLS.
 - ii. The DSS will also use the results from the prediction model and the estimation model.
- g. Concerns and risks –
 - i. DROOLS is flexible, but we must find the balance between flexibility and usability.

1.23. RULES – DECISION SUPPORT RULES

- a. Description – Gather and organize the information needed for response plan creation
- b. Responsible organization – **PATH**
- c. PATH responsibilities – Work with stakeholders to develop the rules, facts, routes, messages, signal timings, etc. needed to build response plans
- d. Other stakeholders – Caltrans, Pasadena, Arcadia, LA County, Monrovia, and Duarte. All central stakeholders must participate in the definition and approval of the rules used to build response plans.
- e. Exclusions: None
- f. Notes –
 - i. PATH rule components must be approved by stakeholders.
- g. Concerns and risks –
 - i. Ability for allowable rules to make a significant difference in traffic congestion

1.24. RULES ENGINE

- a. Description – Configure and integrate the DROOLS rules engine into the CC system
- b. Responsible organization - **PATH**
- c. PATH responsibilities –
 - i. Design
 - 1. Configuration
 - 2. Interfaces
 - ii. Implementation
 - 1. Configuration
 - 2. Interfaces
 - iii. Deploy
 - 1. In the Amazon cloud
 - iv. Test
 - 1. Develop the test harnesses and data
- d. Other stakeholders – None
- e. Exclusions – None
- f. Notes –
 - i. The DSS will use an open source rules engine – DROOLS.

- ii. The DSS will also use the results from the prediction model and the estimation model.
- g. Concerns and risks –
 - i. DROOLS is flexible, but we must find the balance between flexibility and usability.

1.25. DATA HUB

- a. Description – Build a data management environment for the CC System
- b. Responsible organization - **PATH**
- c. PATH responsibilities –
 - i. Design
 - 1. Software
 - 2. Data Structures
 - 3. Interfaces
 - ii. Implementation
 - 1. Software
 - 2. Data Structures
 - 3. Interfaces
 - iii. Deploy
 - 1. In the Amazon cloud
 - iv. Test
 - 1. Develop the test harnesses and data
- d. Other stakeholders –
 - i. Caltrans HQ Ops will own and operate the data hub once the pilot is over. They are involved to ensure the design and implementation are acceptable to them and to gain the knowledge they will need to operate it.
- e. Exclusions – None
- f. Notes –
 - i. The Data Hub will use Kafka, Cassandra, Spark, and Postgis.
 - ii. The Data Hub will integrate with Amazon Web technology.
- g. Concerns and risks –

1.26. ATMS – CMS SIGNS

- a. Description – Integrate CMS data and message status information in the CC system
- b. Responsible organization – **Caltrans D7**
- c. Caltrans responsibilities –
 - i. Ensure that CMS data can be passed using predefined TMDD formats to the CC central system
 - ii. Ensure that commands to set messages on CMS signs can be received from the central CMS system and implemented by the ATMS
- d. Other stakeholders –
 - i. PATH – Provide TMDD interface specification

- e. Exclusions – None
- f. Notes – None
- g. Concerns and risks –
 - i. Caltrans procurement

1.27. ATMS – RAMP METERS

- a. Description – Integrate ramp meter data and receiving suggested metering information into/from the CC system
- b. Responsible organization – **Caltrans D7**
- c. Caltrans responsibilities –
 - i. Ensure that ramp meter data can be passed using predefined TMDD formats to the CC central system
 - ii. Ensure that commands to set ramp metering rates can be received from the central CMS system and implemented by the ATMS
- d. Other stakeholders –
 - i. PATH – Provide TMDD interface specification
- e. Exclusions – None
- f. Notes – None
- g. Concerns and risks –
 - i. Caltrans procurement

1.28. ATMS – LOOP DATA

- a. Description – Provide loop data and metadata to the CC system through PEMS
- b. Responsible organization – **Caltrans**
- c. Caltrans responsibilities –
 - i. Ensure that loop data and metadata data can be passed to PeMS
- d. Other stakeholders
- e. Exclusions – None
- f. Notes
- g. Concerns and risks

1.29. TMDD INTERFACES

- a. Description – Provide TMDD interfaces to CC subsystems
- b. Responsible organization - **PATH**
- c. PATH responsibilities –
 - i. Design
 - 1. Interfaces
 - 2. Data Structures
 - 3. Interfaces
 - ii. Implementation

- 1. Interfaces
- iii. Deploy
 - 1. In the Amazon cloud
- iv. Test
 - 1. Develop the test harnesses and data
- d. Other stakeholders –
 - i. All vendors and stakeholders managing systems must provide information to and receive information from the data hub in TMDD format.
- e. Exclusions – None
- f. Notes –
 - i. TMDD is an industry standard for data exchange.
- g. Concerns and risks –
 - i. The TMDD implementation specification has some implementation challenges that need to be addressed.

1.30. CALL FOR PROJECTS – Foothill Transit

- a. Description – Provide CC event information and traffic diversion information to the Foothill Transit Dispatch Operation. Currently transit is providing static scheduling data only to Metro through RIITS. Provide Open Data System allowing CC event and traffic diversion information to be provided to the transit agency and provide integration assistance to the transit agency.
- b. Responsible organization – **Caltrans D7**
- c. Caltrans responsibilities –
 - i. Define the data to be shared from CC to Foothill Transit
 - ii. Implement any software needed
 - iii. Ensure that foothill transit can receive using agreed-upon formats to/from the CC central system
- d. Other stakeholders –
 - i. Foothill Transit – Will work with Caltrans D7 in defining and implementing the solution
 - ii. PATH – Provide interface specification
- e. Exclusions – None
- f. Notes – Currently Foothill transit only sends static schedule data to RIITS. They are interested and desire to receive CC event and traffic diversion data from DSS and Data Hub, which this project will build interface and furnish to Foothill Transit
- g. Concerns and risks –
 - i. RIITS involved as a middle data broker?

1.31. CALL FOR PROJECTS – Pasadena Transit

- a. Description – Provide CC event information and traffic diversion information to the Pasadena Transit Dispatch Operation. Currently transit is providing static scheduling data

- only to Metro through RIITS. Provide Open Data System allowing CC event and traffic diversion information to be provided to the transit agency and provide integration assistance to the transit agency
- b. Responsible organization – **Caltrans D7**
 - c. Caltrans responsibilities –
 - i. Define the data to be collected
 - ii. Implement any software needed
 - iii. Ensure that Pasadena Transit data can be passed using agreed-upon formats to the CC central system
 - d. Other stakeholders –
 - i. Pasadena Transit – Will work with Caltrans in defining and implementing the solution
 - ii. PATH – Provide interface specification
 - e. Exclusions – None
 - f. Notes – Currently Pasadena transit only sends static schedule data to RIITS. They are interested and desire to receive CC event and traffic diversion data from DSS and Data Hub, which this project will build interface and furnish to Foothill Transit
 - g. Concerns and risks –
 - i. RIITS involved as a middle data broker?

1.32. CALL FOR PROJECTS – AIR QUALITY

- a. Description – Ensure air quality measurements are available to the central CC system
- b. Responsible organization – **Caltrans D7**
- c. Caltrans responsibilities –
 - i. Design, purchase, and install the equipment
 - ii. Ensure the equipment communicates in standard format to the central CC system
 - iii. Implement any software needed
- d. Other stakeholders –
 - i. PATH – Provide interface specification
- e. Exclusions – None
- f. Notes – None
- g. Concerns and risks –
 - i. RIITS involved as a middle data broker?
 - ii. 511 providing the locations (power and communication(?))

1.33. CALL FOR PROJECTS – ARTERIAL DETECTION

- a. Description – Caltrans will help the Cities/County fill their identified traffic signal detection gaps and ensure detection information is connected to the existing traffic signal systems
- b. Responsible organization – **Caltrans D7**
- c. Caltrans responsibilities –
 - i. Using existing system designs, purchase, and install the equipment

- ii. Ensure the equipment communicates in standard format to the city and county TMC. The communication of traffic data will be through existing traffic signal control systems and existing communication networks
- iii. Ensure the equipment meets city/county inspection requirements
- d. Other stakeholders –
 - i. Cities and County – Each city and county must work with Caltrans to provide the information and permits needed for installing arterial detection ITS elements.
- e. Exclusions – None
- f. Notes – None
- g. Concerns and risks –
 - i. There are quite a few locations where these need to be installed.

1.34. CALL FOR PROJECTS – ARTERIAL WAYFINDING SIGN DESIGN

- a. Description – Ensure arterial wayfinding signs’ detailed designs are available to the city and county TMC
- b. Responsible organization – **PATH**
- c. PATH responsibilities –
 - i. Design the wayfinding solutions for the city and county
 - ii. Determine locations, power sources, and communication methods
 - iii. Determine when existing poles can be used and when new poles must be installed
 - iv. Obtain agreement from cities and county
 - v. Provide example detailed design documents meeting Caltrans procurement requirement. The procurement method identified is Invitation to Bid. D7 can provide contract template from Procurement
- d. Other stakeholders –
 - i. Cities and County – Each city and county must work with PATH to provide the information needed for building design documents.
- e. Exclusions – None
- f. Notes –
 - i. PATH is not responsible for installing the signs.
- g. Concerns and risks –
 - i. There is not yet agreement on sign types, and there may be funding challenges based on pole installation and power.
 - ii. The solution must meet the current budget established through the funding agreement between Metro and D7

1.35. CALL FOR PROJECTS – ARTERIAL WAYFINDING SIGN CONTROL SOFTWARE

- a. Description – Ensure wayfinding sign control software is available to Pasadena, Arcadia, Monrovia, Duarte, and LA County
- b. Responsible organization – **PATH**
- c. PATH responsibilities –

- i. Manage the identification of sign control software
 - ii. If PATH cannot use the OEM's sign control system C2C software or it does not exist, PATH may need to purchase new C2C software.
 - iii. Install the software
 - iv. Ensure the C2C interface is implemented between city and county TMCs and the central CC system
- d. Other stakeholders –
 - i. Cities and County – Each city and county must work with Caltrans to provide the information and permits needed for installing arterial detection ITS elements.
- e. Exclusions – PATH cannot succeed without the support of all stakeholders, as this deliverable involves physical and logical changes to their IT systems.
- f. Notes –
 - i. If PATH is purchasing this software, then funding must be allocated.
- g. Concerns and risks –
 - i. Timing and cost and C2C capability

1.36. CALL FOR PROJECTS – ARTERIAL WAYFINDING SIGN INSTALLATION

- a. Description – Ensure arterial wayfinding signs are installed and available to the city and county TMC
- b. Responsible organization – **Caltrans D7**
- c. Caltrans D7 responsibilities (through purchase contract)
 - i. Purchase the equipment
 - ii. Install the equipment
 - iii. Ensure the equipment communicates in the equipment manufacturer's standard control format using the existing city/county communication network to the city and county TMC
 - iv. Test the equipment
- d. Other stakeholders –
 - i. PATH – Path will provide the designs (sign type, location, power location, communication method) to Caltrans D7.
 - ii. Cities and County – Each city and county must work with Caltrans to provide the information and permits needed for installing arterial detection ITS elements.
- e. Exclusions – None
- f. Notes – None
- g. Concerns and risks –
 - i. There are quite a few locations where these need to be installed.
 - ii. The condition of conduits may not be known in advance.
 - iii. Caltrans is responsible for fulfilling the needs based on the established budget from the Call for Project's fund. Caltrans cannot guarantee that the recommended implementation cost won't exceed the budget amount

1.37. CALL FOR PROJECTS – BLUETOOTH

- a. Description – Caltrans is to install additional Bluetooth devices in locations filling the existing detection gaps. These new devices will be connected to each entity’s existing communication network to each existing TMC. Caltrans is not responsible for the travel time availability to CC system (not a part of FA scope of work).
- b. Responsible organization – **Caltrans D7**
- c. Caltrans responsibilities (through purchase contract) –
 - i. Using existing system designs, purchase, and install the equipment
 - ii. Ensure the equipment communicates in standard format to a location accessible from the central CC system
 - iii. Test the equipment
- d. Other stakeholders –
 - i. Cities and County – Each city and county must work with Caltrans to provide the information and permits needed for installing arterial detection ITS elements.
 - ii. PATH – Provide formats for data
 - iii. PATH – Read the data from the central Bluetooth servers into the data hub
- e. Exclusions – None
- f. Notes –
- g. Concerns and risks - None

1.38. CALL FOR PROJECTS – CABINETS AND CONTROLLERS

- a. Description – Ensure cabinet and controller upgrades are performed
- b. Responsible organization – **Caltrans D7**
- c. Caltrans responsibilities (through purchase contract) –
 - i. Using existing system designs, purchase, and install the equipment
 - ii. Ensure the equipment communicates in standard format to the city and county TMC
 - iii. Where controllers are changed, work with cities and county to load signal plans
 - iv. Test the equipment
- d. Other stakeholders –
 - i. Cities and County – Each city and county must work with Caltrans to provide the information and permits needed for installing cabinets and controllers.
- e. Exclusions – None
- f. Notes – None
- g. Concerns and risks –
 - i. Ensuring no significant construction is required as part of the installation

1.39. CALL FOR PROJECTS – COMMUNICATION

- a. Description – Ensure new communication devices are available to cities and county
- b. Responsible organization – **Caltrans D7**
- c. Caltrans responsibilities (through purchase contract) –

- i. Using existing system designs, purchase, and install the equipment
 - ii. Ensure the equipment communicates in standard format to the city and county TMC
 - iii. Test the equipment
- d. Other stakeholders –
 - i. Cities and County – Each city and county must work with Caltrans to provide the information and permits needed for installing these ITS elements.
- e. Exclusions – None
- f. Notes – None
- g. Concerns and risks –
 - i. This is likely to require support from the system vendors. Who will pay for this?
 - ii. There may be issues with wireless communication.

1.40. PERSONNEL - KSA AND ORGANIZATIONAL DESIGN

- a. Description – Ensure the human requirements for the pilot are met
- b. Responsible organization – **PATH**
- c. PATH responsibilities –
 - i. Work with stakeholders to define the personnel and organizations needed to meet the CC human requirements
 - ii. Define the KSAs needed
 - iii. Work with stakeholders to provide education and training
- d. Other stakeholders –
 - i. Caltrans, Cities, and County – Caltrans D7 and each city and county must work with PATH to develop human and organizational solutions appropriate for their organizations.
 - ii. Caltrans, Cities, and County must prioritize appropriate resources.
- e. Exclusions – None
- f. Notes –
 - i. PATH is not responsible for hiring personnel for other organizations.
- g. Concerns and risks –
 - i. CC is a new way of interacting, requiring additional skill sets and cultural approaches beyond what is in place today. It is not clear where these resources will originate or how funding will be provided.
 - ii. Cultural change is difficult. There are risks of failure if strong focus is not placed on the human requirements.

1.41. OUTREACH

- a. Description – Ensure appropriate public relations and communications occur
- b. Responsible organization – **PATH**
- c. PATH responsibilities –
 - i. Ensure information and plans are shared with stakeholders and their governing personnel and bodies

- ii. Provide information to news organizations, publications, and other agencies interested in tracking progress on the CC program
 - iii. Publish the Connected newsletter
- d. Other stakeholders –
 - i. All stakeholders – All stakeholders at one time or another request information or briefings on the program. They will work with PATH on ensuring these presentations are a success.
- e. Exclusions – None
- f. Notes - None
- g. Concerns and risks –
 - i. Caltrans is leading the CC effort, and care must be taken to ensure that PATH is not viewed as the leader when outreach is performed.