I - 95 CORRIDOR COALITION

Emerging Technologies in Transportation Management Webinar

January 30, 2020

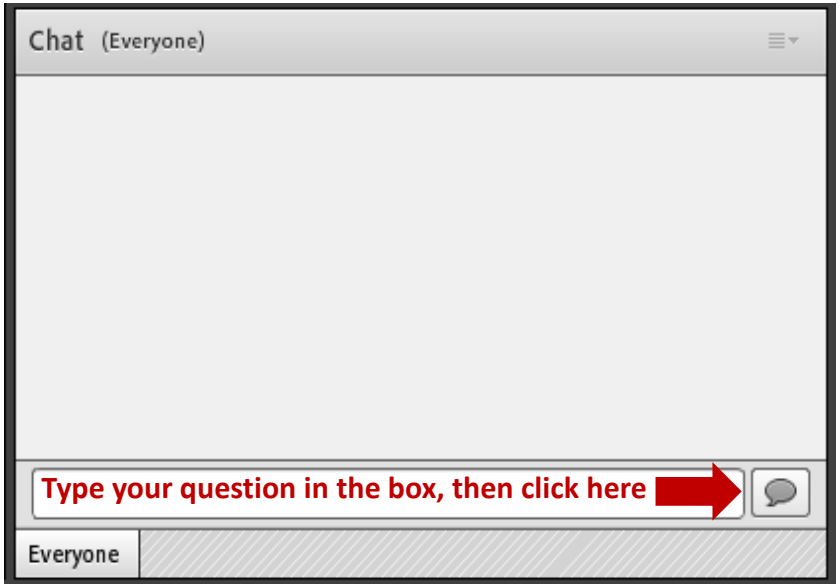
Call Number: xxxx - Enter xxxx at the prompt

Webinar & Audio Information

- The call-in phone number is: **xxxx & enter xxxx at the prompt**
- **Participants will be in "Listen Only" mode throughout the webinar**
- Please press *0 to speak to an operator for questions regarding audio
- Please call Justin Ferri at xxxx for difficulties with the web or audio application
- This webinar will be recorded
- Presentations will be posted to the I-95 Corridor Coalition website. Participants will receive a link to the presentations after they are posted.

Asking Questions

- Please pose your questions using the **chat box**
- Questions will be monitored then answered by the speakers either at the end of their presentation or at the end of the webinar



Welcome and Introductions

Denise Markow, PE

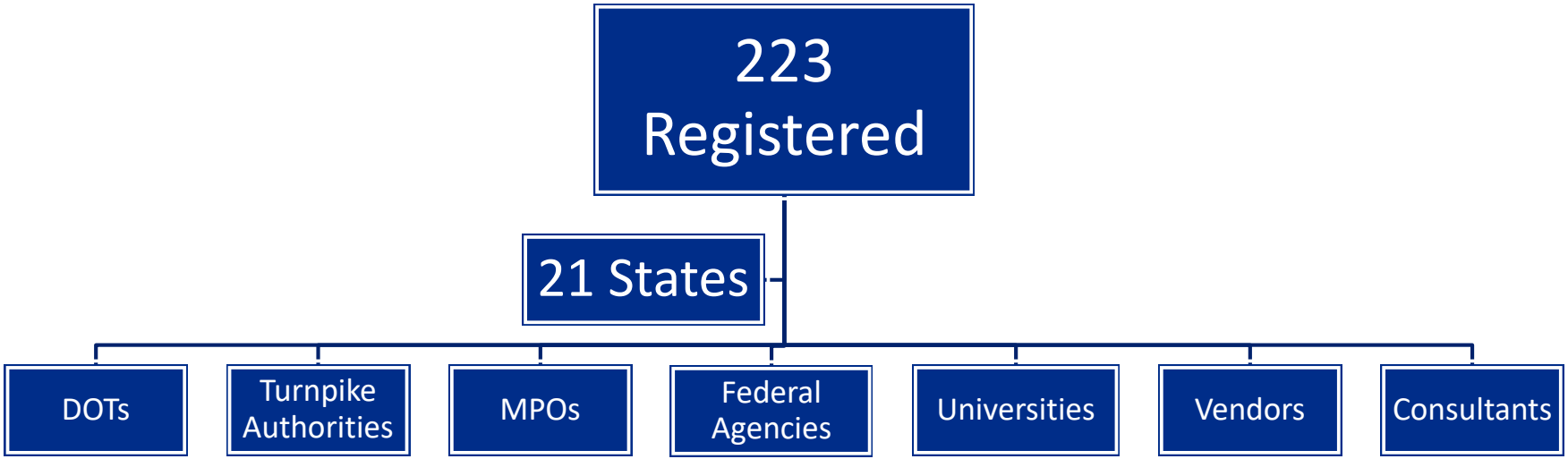
I-95 Corridor Coalition

TSMO Director

Agenda

1:00 pm to 1:05 pm	Welcome and Introductions	Denise Markow, PE, I-95 Corridor Coalition
1:05 pm to 1:25 pm	The Use of Artificial Intelligence in Transportation Management Centers	Gene Donaldson, Delaware DOT
1:25 pm to 2:25 pm	Breaking Ground: Toward a National ICM Strategy (Showcasing: I-210 Connected Corridors) in California	Nick Compin, PhD, Caltrans Joe Butler, UC Berkeley
2:25 pm to 2:30 pm	Wrap Up	Denise Markow, PE, I-95 Corridor Coalition

I-95 Corridor Coalition Sponsored Event



Who we are…

Multi-modal • Multi-jurisdictional • Multi-disciplinary




Formed in 1993, the I-95 Corridor Coalition is a partnership of multi-state, multi-modal public agencies working together to create a seamless and efficient transportation system.

We connect people, tools, and resources to help agencies tackle the sticky issues and get solutions across the finish line.

Our Core Programs & Goals

Executive Board
Chair & 4 Vice-Chairs

Coalition Staff & Consultants

Executive Director

Steering Committee

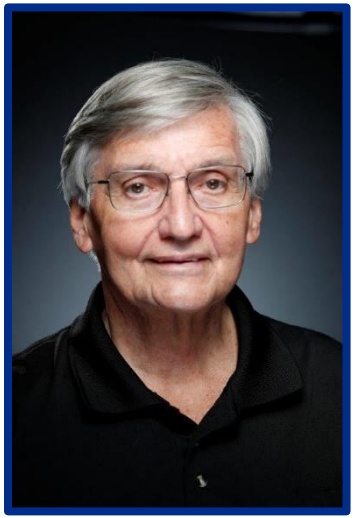
Program Tracks

Transportation Systems Management & Operations
- Operations Exchanges
- Traveler Info
- Data Tools & Research
- Operations Academy

Intermodal Freight
- Freight Plans
- Freight Fluidity
- Truck Parking
- Freight Academy

Innovations in Transportation
- Connected & Autonomous Vehicle
- Tolling Reciprocity
- Mileage-Based User Fees

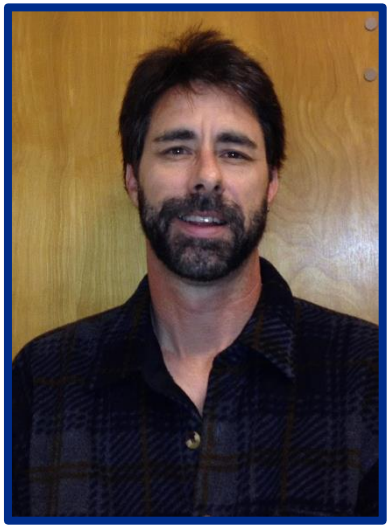
Introductions



Gene Donaldson

Delaware Department of Transportation

TMC Operations Manager



Nick Compin, PhD

California Department of Transportation

Statewide Connected Corridors, TSMO & System Performance Measures Lead

Joe Butler

University of California, Berkeley

Connected Corridors Program Engineering Manager

The Use of Artificial Intelligence in Transportation Management Centers

Gene Donaldson
Delaware DOT

The Use of Artificial Intelligence in Transportation Management Centers

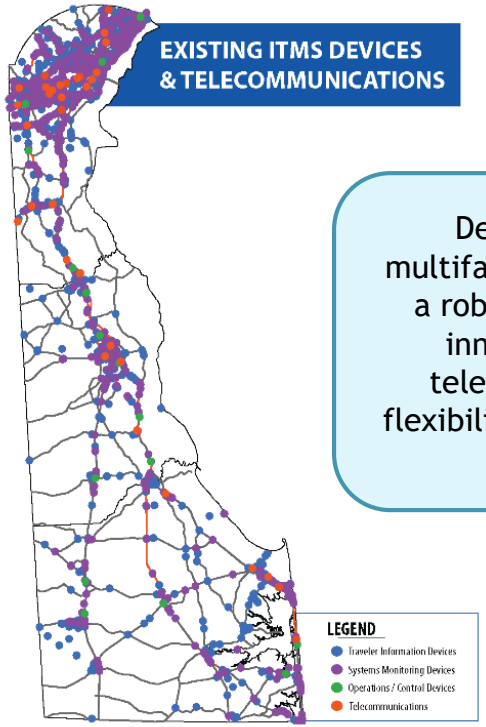
I95 Corridor Coalition

Delaware Department of Transportation (DelDOT)

Gene Donaldson, DelDOT TMC Manager

https://deldot.gov/programs/itms

DelDOT's Integrated Transportation Management System (ITMS)

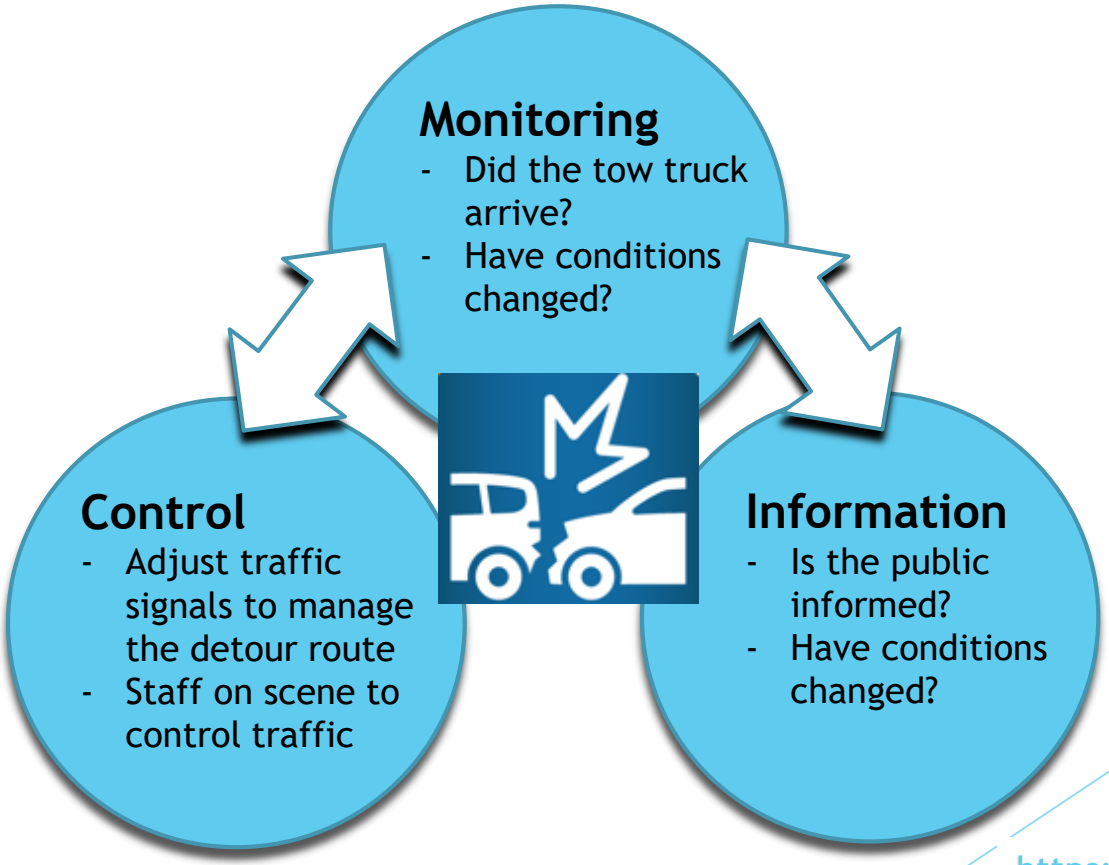


DelDOT's existing multifaceted ITMS provides a robust foundation for innovation built on telecommunications, flexibility and an adaptable system

AI-ITMS

https://deldot.gov/programs/itms

Critical Functions of ITMS



DelDOT ITMS Strategic Plan

https://deldot.gov/Publications/index.shtml

- 2017 update to the ITMS Strategic plan
- Addresses emerging technologies and DelDOT's existing leverage for implementation:
  - Telecommunications Network
  - Traffic Signal and Intelligent Transportation System (ITS) Device Integration into Transportation Management Center (TMC)
  - Transit Integration
  - DelDOT Mobile Application
- The next phase of ITMS will incorporate Artificial Intelligence (AI) and Machine Learning (ML)

AI-ITMS

https://deldot.gov/programs/itms

Artificial Intelligence-enhanced ITMS Objectives

- **Create** and **maintain** an enhanced ITMS that will predict traffic anomalies and adapt management and operations in real-time for current traffic conditions.
- Adopt and deploy **AI and ML** technologies to **automate** multimodal system tasks (e.g. data collection, analysis, decision support, and solution evaluation processes)
- **Monitor** all components of DelDOT's ITMS and **optimize** performance to improve **safety, mobility, sustainability, economic vitality, and air quality**
- Prepare DelDOT's TMC to integrate **emerging transportation technologies** more efficiently and effectively

DelDOT ATCMTD Grant Award

- Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Grant program:
  - Established under the Fixing America's Surface Transportation (FAST) Act to create competitive grants to deploy advanced transportation technologies with the goal of improving safety, efficiency, system performance, and infrastructure return on investment.
- DelDOT proposed the AI-ITMS for the FY 2018 ATCMTD Grant Program
  - After reviewing 51 applications, FHWA selected 10 to receive grant funds
  - DelDOT was awarded a $4.9M ATCMTD Grant in April 2019.
  - The State of Delaware will match this grant award for a total project cost of $10M.

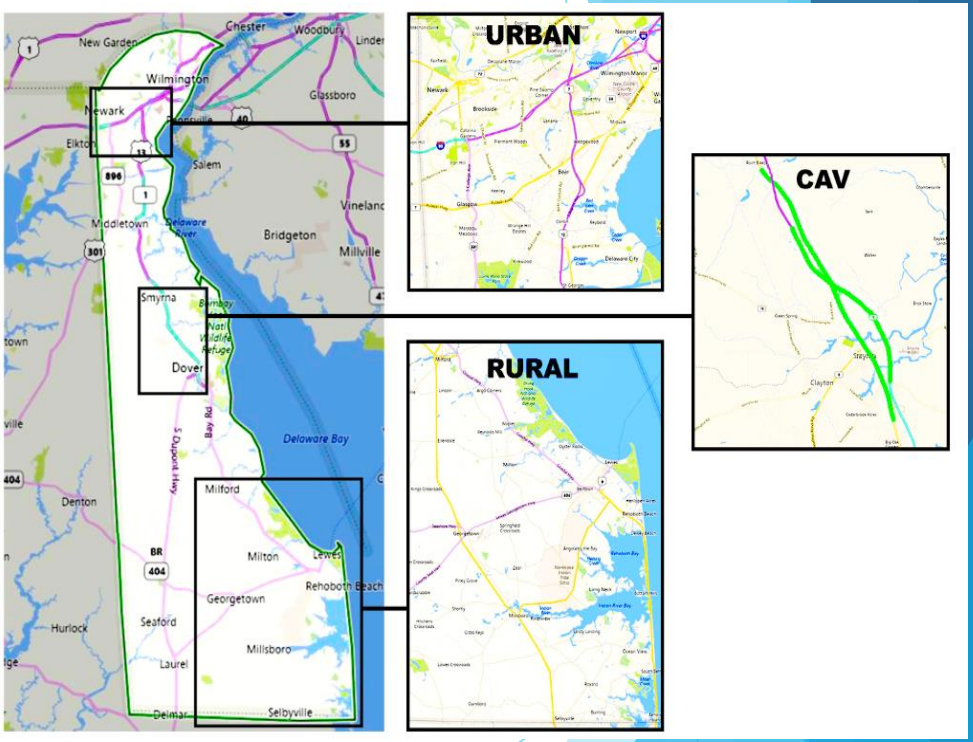
"These highly innovative projects offer high-tech solutions to relieve congestion and improve safety and efficiency on the nation's highways,"

- Elaine L. Chao, U.S. Transportation Secretary

https://deldot.gov/programs/itms

AI-ITMS Deployment

- Implementation will occur over a duration of **three** years in **three** project areas.
- The project team is led by the **DelDOT Division of Transportation Solutions,** supported by:
  - **Jacobs Engineering** – Program Management Consultant
  - **Intelligent Automation, Inc. (IAI)** – Technical Consultants
  - **University of Delaware** – supporting program evaluation by monitoring and reporting on project and program benefits



AI-ITMS

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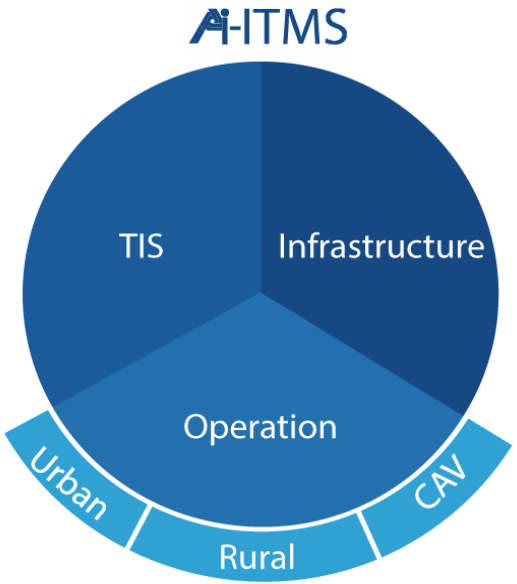
AI-ITMS Deployment



Traveler Information System

Update the DelDOT website and mobile application to better inform the public of the information generated by the AI-ITMS program.

Infrastructure

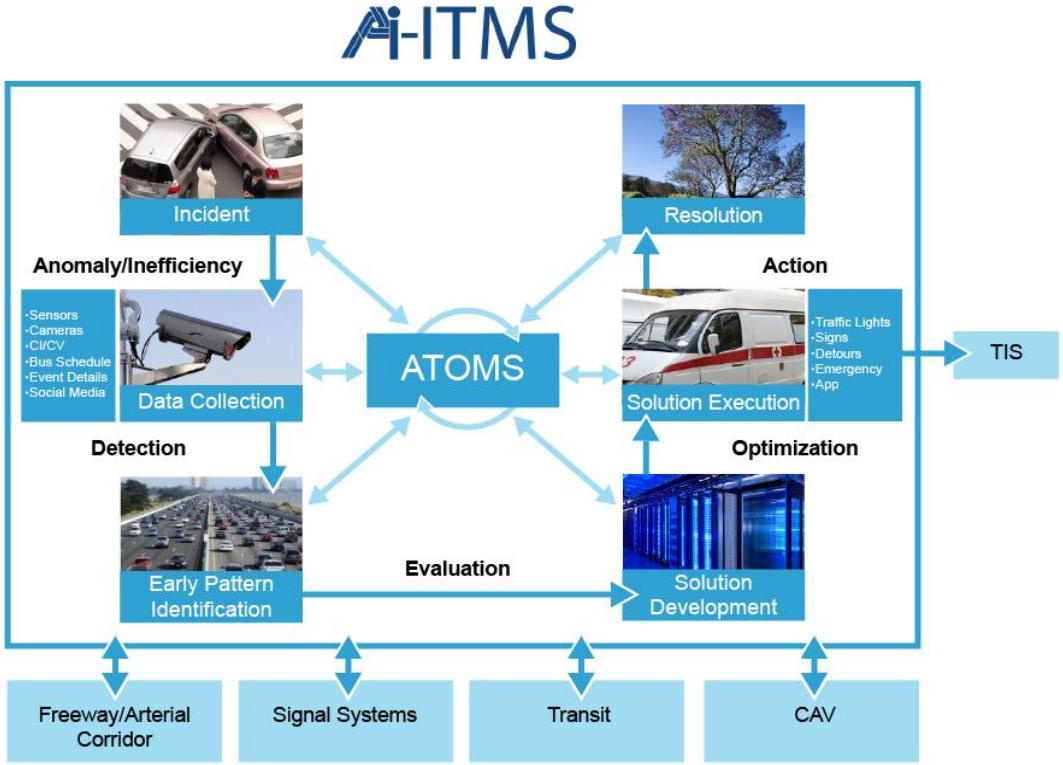
Upgrade and deploy advanced sensors, video cameras, connected infrastructure, and transportation management system hardware and software to support the deployment of AI-ITMS.

Operation

Development, integration, deployment, and testing of the AI-based software; includes three subprojects in distinct traffic networks: **Urban**, **Rural**, and **CAV**.

Expected Outcomes

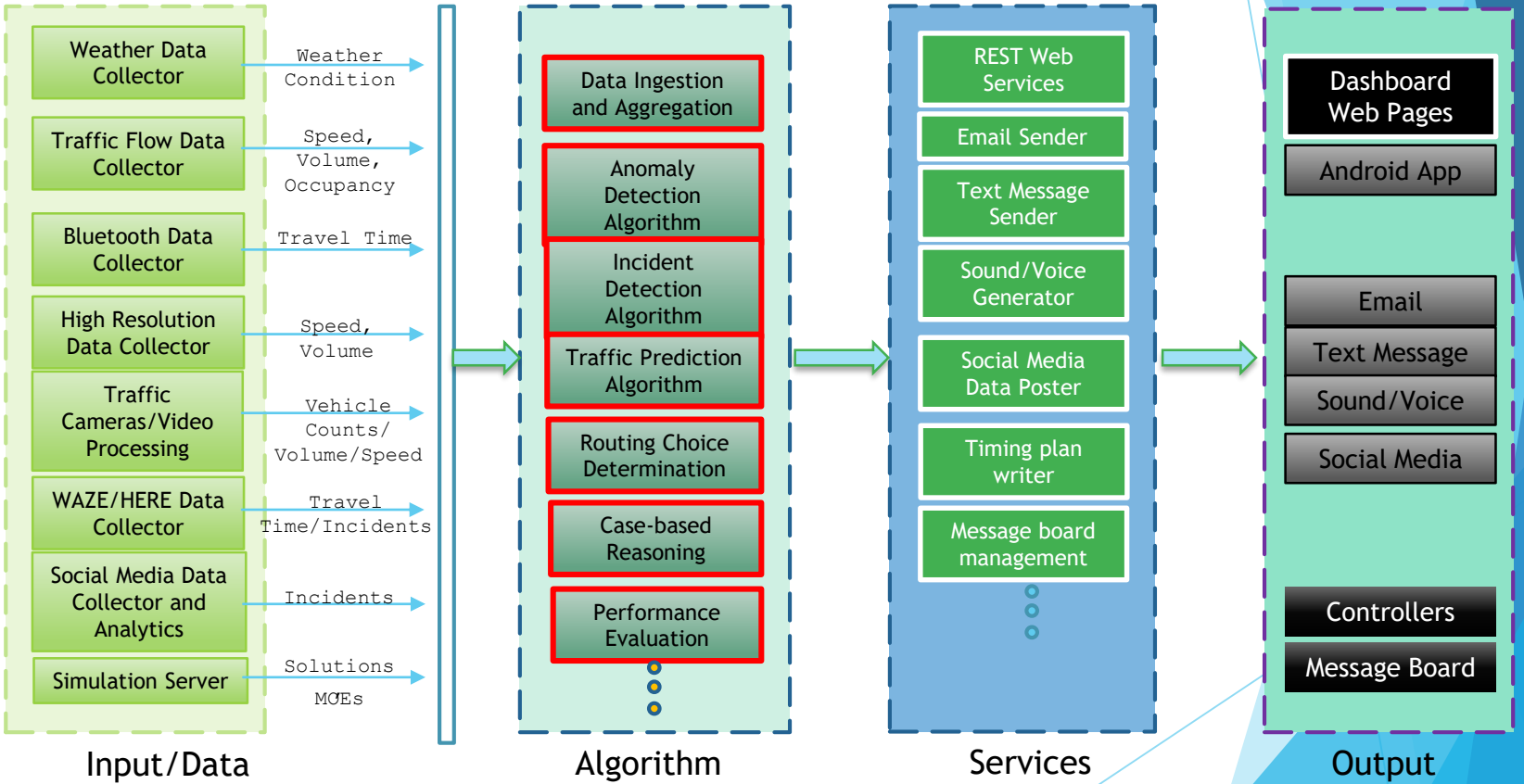
- A truly predictive and adaptive self-monitoring transportation management system
- Automated operation and enhanced decision making
- Reduced incident detection time
- Monitoring of CAV operation leveraging data for improved traffic management
- Getting smarter over time for transportation management and operations



Ai-ITMS

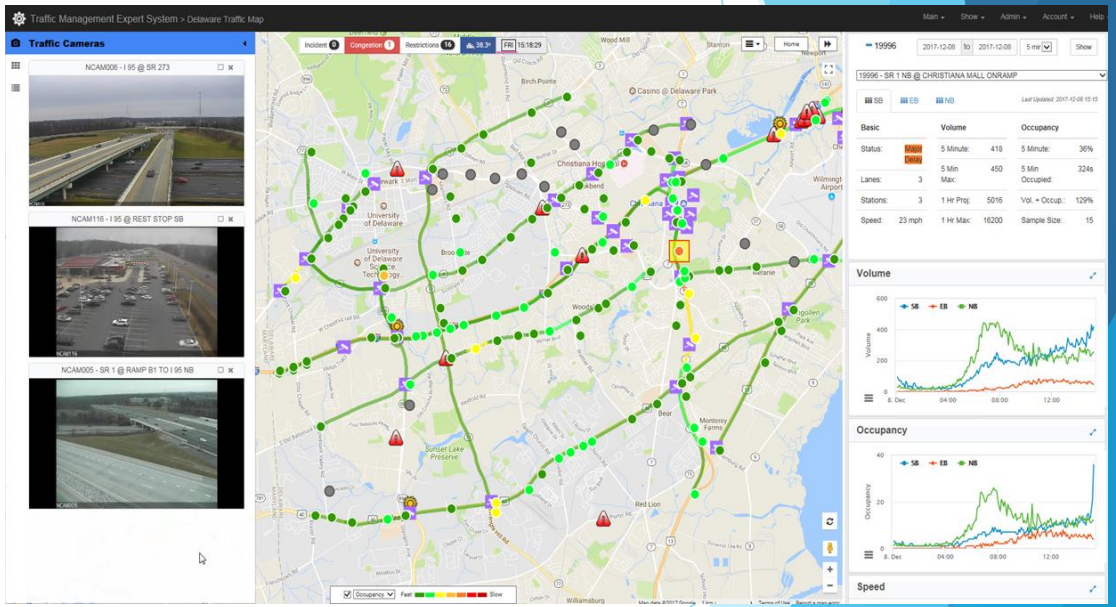
https://deldot.gov/programs/itms

AI-TOMS Software Diagram



Current Project Status

- ATCMTD Program Start: October 1, 2019
- Working on System Engineering Documents and Project Evaluation Plan
- Computer hardware and software are being procured
- Development team is working on data collection, aggregation and analysis tasks
- Current software capabilities:
  - Process live traffic detector data (update every 5 minutes) for anomaly detection
  - 24/7 continuous monitoring, instantaneous alert (email, message) and reporting the event
  - Automatic data visualization and CCTV camera video confirmation
  - Traffic flow prediction



A-ITMS

https://deldot.gov/programs/itms

ITMS

For more information:

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www.deldot.gov

Breaking Ground: Toward a National ICM Strategy

(Showcasing: I-210 Connected Corridors) in California

Nick Compin, PhD, Caltrans, Statewide Connected Corridors, TSMO & System Performance Measures Lead

Joe Butler, UC Berkeley Connected Corridors Program Manager

Breaking Ground: Toward a National ICM Strategy (Showcasing: I-210 Connected Corridors) in California

January 30, 2020

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Agenda

- Caltrans Statewide Connected Corridors (CC) Program
- I-210 ICM - Connected Corridors Pilot Project
- UC Berkeley PATH's Role
- ICM System – Architecture, Design, Standards
  - Data Hub and C2C Interfaces
  - Decision Support System (DSS)
  - Corridor Management System (CMS)
- Status and Schedule
- Caltrans Planned System Deployments
  - Caltrans D12 Orange County Additional Applications
  - Statewide Program Readiness
- Benefits of Open Source and Pooled Fund

I-210 Pasadena, CA

I-210 Pasadena, CA

I-210 Pasadena, CA

California Connected Corridors Statewide Program

Consultants

Aimsun

Kapsch

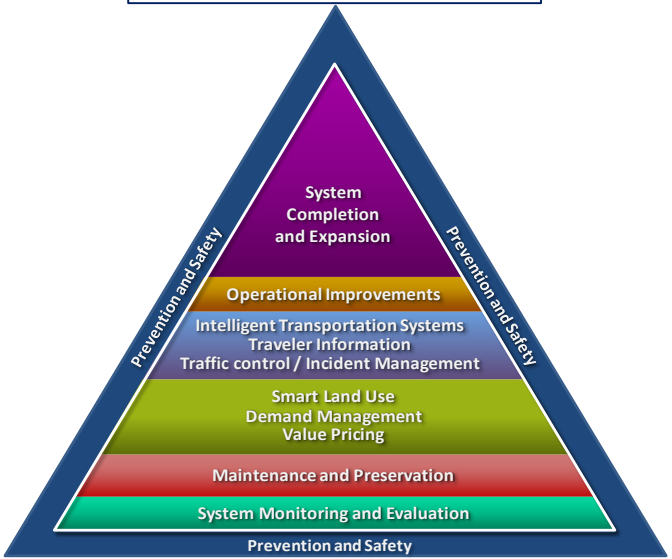
Parsons

Telegra

How to get more out of the transportation network we have?

Mobility, TSMO, & Connected Corridors

Caltrans Mobility Pyramid



Connected Corridors is only one of numerous strategies Caltrans is using to conduct Transportation Systems Management and Operations (TSMO)

California Connected Corridors Program & Pilot

Caltrans uses the term *Connected Corridors*, "branding" our effort, to highlight the statewide program and to differentiate Caltrans' Program from FHWA or other efforts.

- **A statewide program focused on:**
  - Bringing ICM to major corridors across California
  - Growing Caltrans leadership in corridor based transportation management
  - Showcasing new technologies and processes
  - Delivering an ICM implementation on the I-210 in Los Angeles
  - Renewing/Establishing and Adhering to Statewide Standards
  - **Providing a solution that is affordable, replicable and scalable**
- **Lowering the barriers to ICM adoption, operation, and maintenance:**
  - Funding and Costs
  - Workforce skills
  - Technical Complexity and Risk

Why a Single Statewide System?

Traffic Operations Program Manager Direction:

- **Control costs through economies of scale and provide uniform data from across the state for performance measurement**
  - **Replicable** * Common system must be easily replicable for uniform statewide use
  - **Scalable** * Common system must be flexible to meet the unique needs of the districts
  - **Affordable** * Cost sharing with local partners must be easy and defensible
  - **Maintainable** * Single statewide maintainer with Caltrans IT performing this function

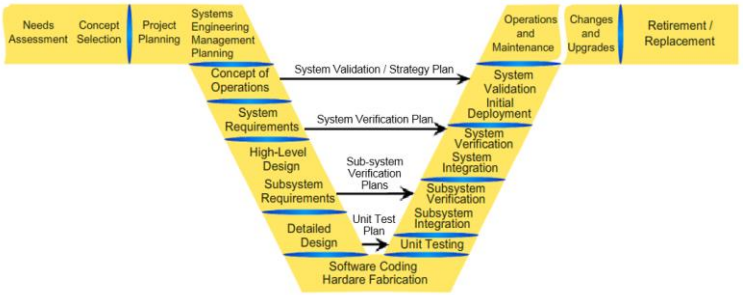
❖ Design must meet current and future needs of I-210 Pilot stakeholders and future needs of local partners across California.

Caltrans and UCB PATH Collaboration

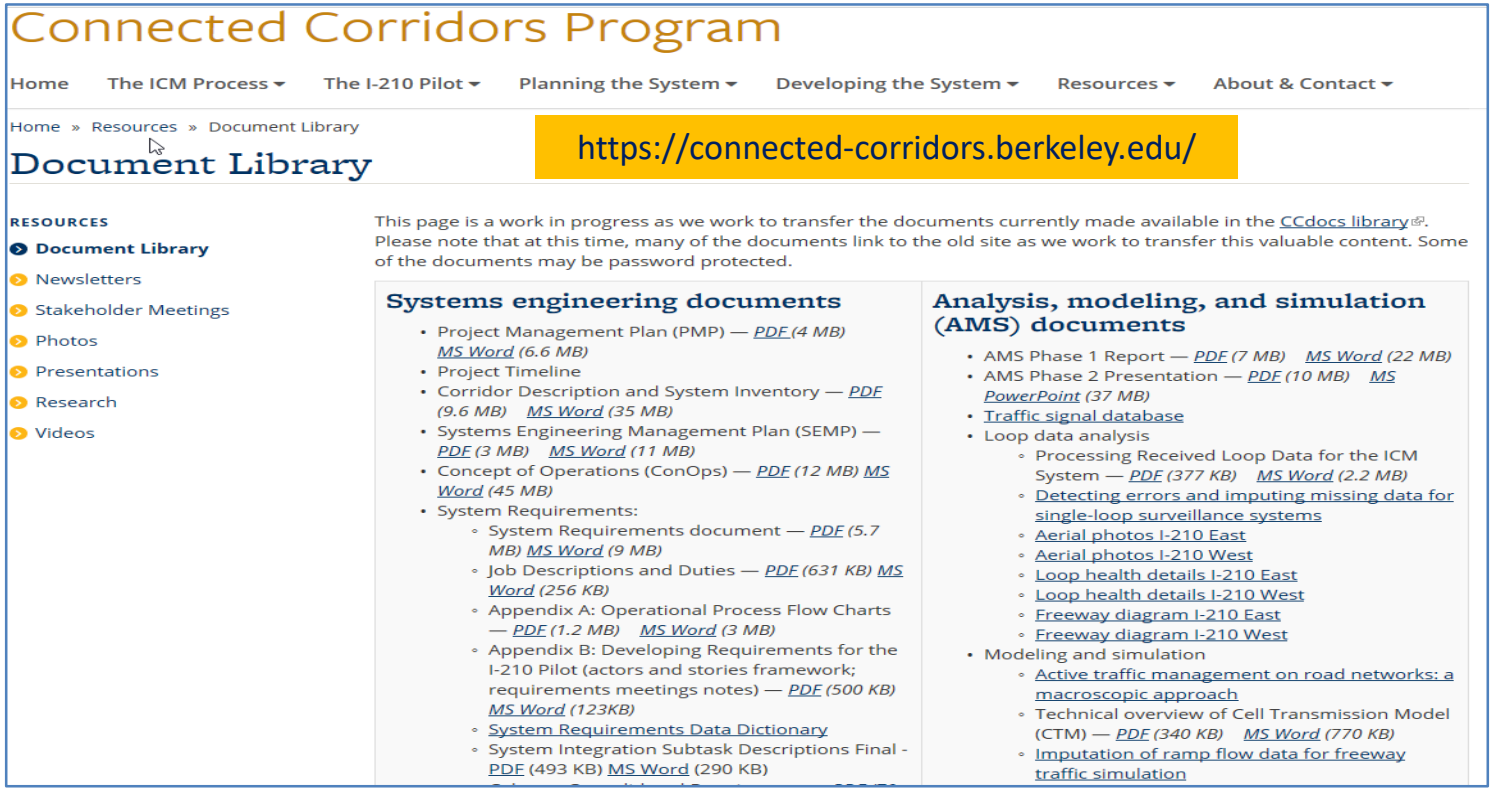
- **Provide system engineering documents and process templates**
- **Provide guidance on workforce skills, training and organization**
- **Enable the consulting ecosystem**
- **Provide a *cloud based* reference implementation architecture with data quality**
- **Provide a *cloud based* replicable and scalable intelligent data hub and DSS (Decision Support System)**

Documentation - Templates, Standards, and Processes

- High quality system engineering documents
- Document technical, human and organizational requirements
- Create examples of MOUs and charters
- Create Data Quality Standards
- Provide Model Calibration guidance
- Organize for tailoring by each ICM effort



Sharing What We Learn and Create



Connected Corridors Program

Home | The ICM Process | The I-210 Pilot | Planning the System | Developing the System | Resources | About & Contact

Home » Resources » Document Library

https://connected-corridors.berkeley.edu/

Document Library

RESOURCES

- Document Library
- Newsletters
- Stakeholder Meetings
- Photos
- Presentations
- Research
- Videos

This page is a work in progress as we work to transfer the documents currently made available in the CCdocs library. Please note that at this time, many of the documents link to the old site as we work to transfer this valuable content. Some of the documents may be password protected.

Systems engineering documents

- Project Management Plan (PMP) — PDF (4 MB) MS Word (6.6 MB)
- Project Timeline
- Corridor Description and System Inventory — PDF (9.6 MB) MS Word (35 MB)
- Systems Engineering Management Plan (SEMP) — PDF (3 MB) MS Word (11 MB)
- Concept of Operations (ConOps) — PDF (12 MB) MS Word (45 MB)
- System Requirements:
  - System Requirements document — PDF (5.7 MB) MS Word (9 MB)
  - Job Descriptions and Duties — PDF (631 KB) MS Word (256 KB)
  - Appendix A: Operational Process Flow Charts — PDF (1.2 MB) MS Word (3 MB)
  - Appendix B: Developing Requirements for the I-210 Pilot (actors and stories framework; requirements meetings notes) — PDF (500 KB) MS Word (123KB)
  - System Requirements Data Dictionary
  - System Integration Subtask Descriptions Final - PDF (493 KB) MS Word (290 KB)

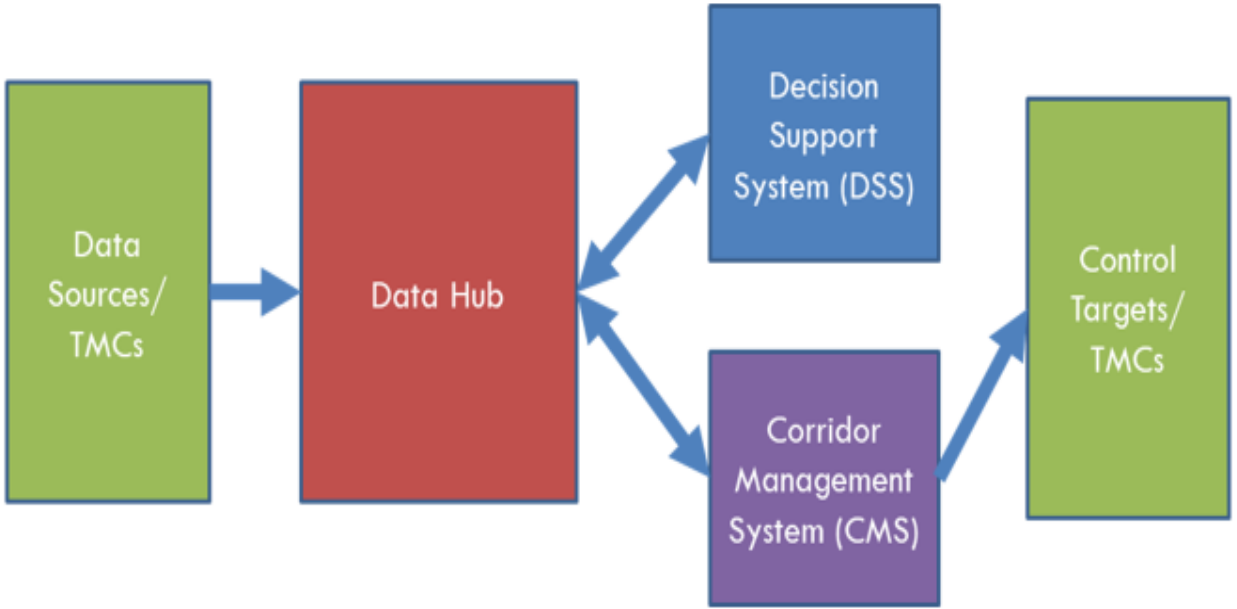
Analysis, modeling, and simulation (AMS) documents

- AMS Phase 1 Report — PDF (7 MB) MS Word (22 MB)
- AMS Phase 2 Presentation — PDF (10 MB) MS PowerPoint (37 MB)
- Traffic signal database
- Loop data analysis
  - Processing Received Loop Data for the ICM System — PDF (377 KB) MS Word (2.2 MB)
  - Detecting errors and imputing missing data for single-loop surveillance systems
  - Aerial photos I-210 East
  - Aerial photos I-210 West
  - Loop health details I-210 East
  - Loop health details I-210 West
  - Freeway diagram I-210 East
  - Freeway diagram I-210 West
- Modeling and simulation
  - Active traffic management on road networks: a macroscopic approach
  - Technical overview of Cell Transmission Model (CTM) — PDF (340 KB) MS Word (770 KB)
  - Imputation of ramp flow data for freeway traffic simulation

Caltrans

CALIFORNIA PATH

Major Connected Corridors System Components



Caltrans and UC Berkeley

- **Caltrans – Division of Operations**
  - Supports 21 Million Licensed drivers
  - LA and Bay Area Congestion
  - Focus on TSMO and not on building

- **UC Berkeley – Institute of Transportation Studies**
  - Created in 1948 by the California State Legislature
  - More than 100 graduate students at any time
- **PATH – Partners for Advanced Transportation Technology**
  - First Automated Driving Demonstration
  - First loop detection system (PEMS)
  - Focused on moving ideas to realization
- **Connected Corridors Program**
  - 20 Professional Staff

Mission – Make this work across all of California (repeatedly)

Our Mission - Enable 21st Century Traffic Management

- **Develop a long term, holistic vision for 21st century traffic management**
- **Implement this vision through technology, education and legislation**
- **Pilot this implementation on the I-210**
- **Open Source the implementation**
- **Train the transportation ecosystem in this implementation**
- **Fan it out across California and the nation**

Design/Build

Define › Design › Deliver

Goals – Overcome existing challenges

- **Costs**
- **Lack of IT expertise**
- **Unable to handle big data**
- **Not setup for AI/Machine Learning**
- **Existing systems do not really use current technology**
- **Operating integrated systems**
- **Reliance on servers managed by IT**
  - Difficult to grow, handle service disruptions, and keep current.
  - Scaling requires new purchases.

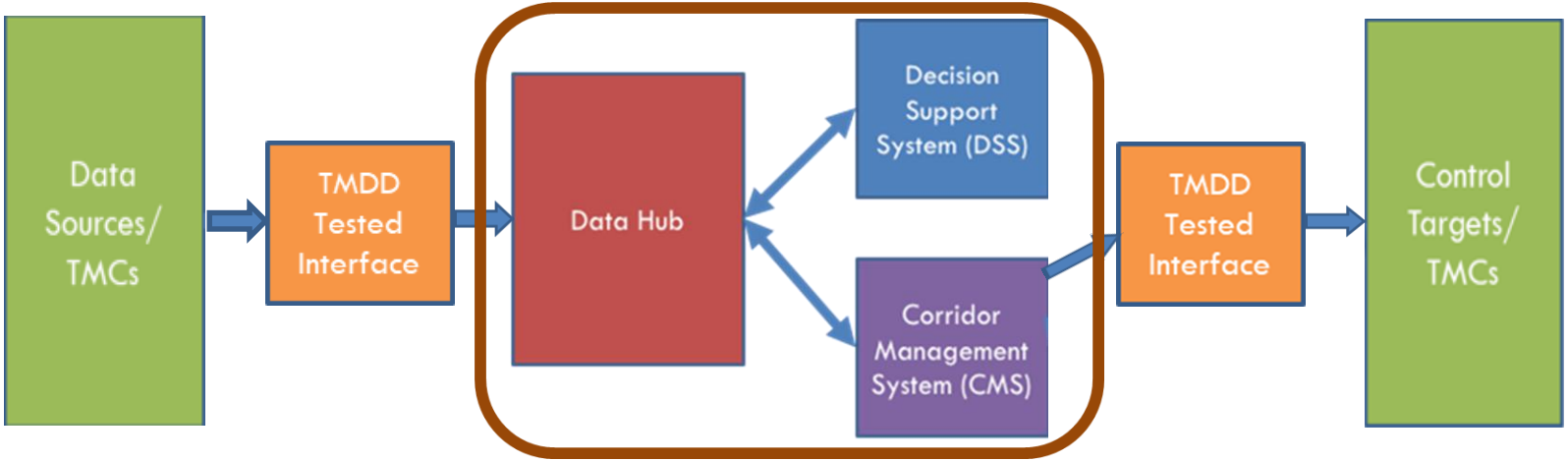
Technical Concepts

- Decision support system based on “big” data, rules, and AI/Machine Learning
- Best ideas from Silicon Valley and Academia
- BIG data (Connected Vehicles, intelligent devices)
- System wide decisions involving people, vehicles and ITS devices
- Data Hub is the core to which other features are added
- Data Exchange standards are essential to success (C2C using TMDD)
- Widespread use through affordability, scalability, and configurability
- Efficient timelines using interface standards and automated installations
- “Raise all boats” in the transportation sector including agencies, vendors and consultants by open sourcing the results

Design Objectives, Constraints, and Principles

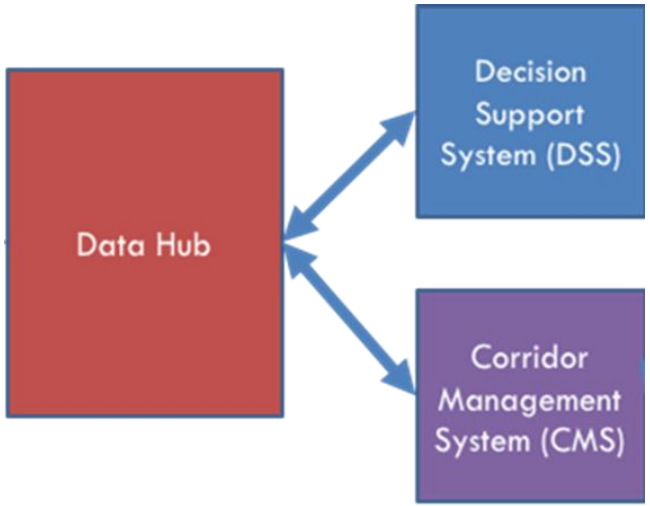
- Real time operation
- Speed to decision
- Security – minimize exposed surface, least privilege
- Scalable
- Maintainable, Operable by Regions/DOTs
- Flexibility for future with modular design
- Resilient, reliable

Major System Components



Core Components

- **Data Hub – Receives, processes, stores and delivers large amounts of different data types**
- **Decision Support System – Provides transportation network strategies through rules, modeling, and traffic state estimation**
- **Corridor Management System – Provides data visualization, response plan management and response plan implementation functions**
- **Design**
  - Clean separation of responsibilities
  - Modular implementation providing user choice
  - Different scalability

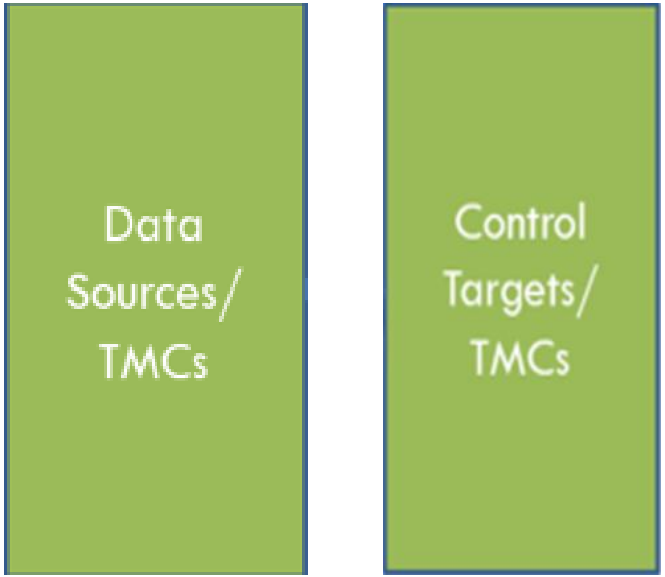


TMDD Data Interfaces

- **Standardized interfaces – Critical to the vision**
  - Traffic Management Data Dictionary 3.03d
  - Issues with TMDD addressed, trying to stay true to TMDD as much as possible
  - Vendor specific capabilities in extensions
- **Use Data Hub processing to address vendor differences**
- **Data Hub uses TMDD data structures in internal messaging systems**
  - Thus different DSS or CMS implementations that meet the interface standard can be used

Data Sources, Control Targets

- **External systems that have implemented a C2C interface using our TMDD standard**
- **Plug and play once the interfaces are built**
  - Traffic Signal Systems
  - Ramp Meter Systems
  - Signs
  - Lane Closure Systems
  - ATMS if desired
  - Transit
  - Travel Time
  - Designed for Connected Vehicles



Technical Summary - Mix and Match

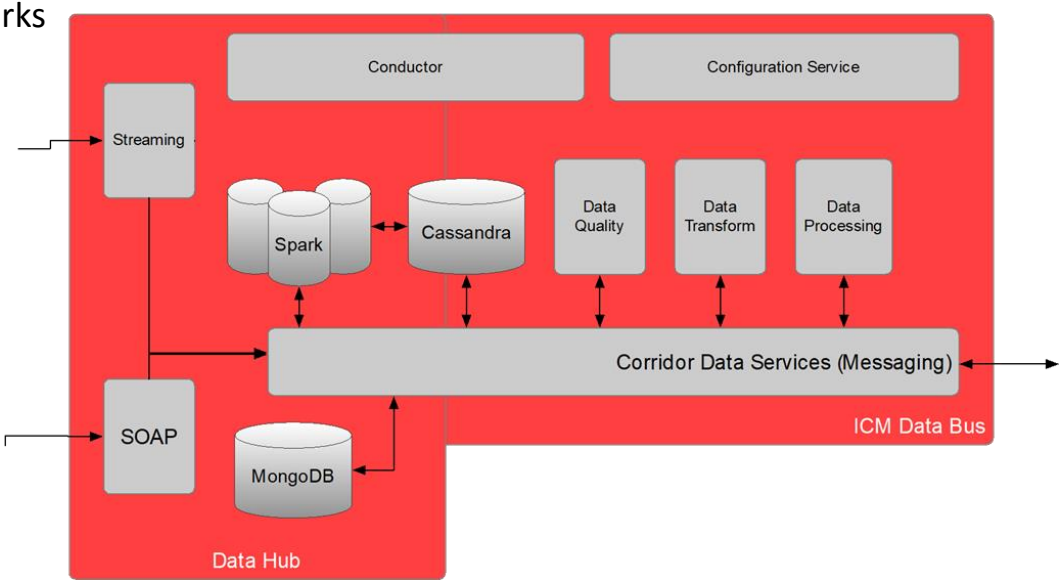
Standardized, tested Interfaces

Overall Architecture

- Cloud – Amazon Web Services (AWS) for security, scalability, reliability and ease of deployment and maintenance
- Micro services Architecture – System components operating through a common messaging systems (Kafka and Active MQ)
- Internal workflow engine – Netflix “Conductor”
- Extensive testing framework – “Jmeter”
- Language – Java
- Databases - Cassandra and Mongo
- Monitoring software – Graylog, in-house built
- Architecture has been peer reviewed by multiple organizations

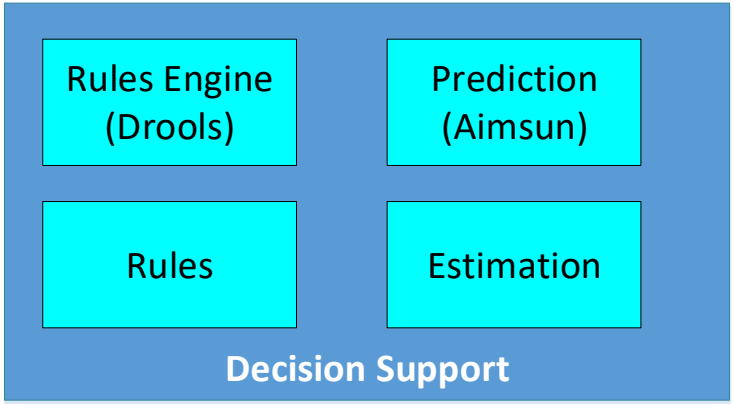
Data Hub

- **Two types of data**
  - Streaming – High Volume connected vehicle data
  - Structured - Document (XML), networks
- **Two databases deployed as clusters**
  - Cassandra for streaming
  - Mongo for documents
- **Data Quality**
  - Kafka processors
  - Spark machine learning clusters
- **Netflix Conductor**
  - Workflow Management



Decision Support System

- Core Rules system – Drools
- Rules - Excel spreadsheets used to capture the rules needed for traffic management strategy selection
- Estimation – Traffic algorithms used to determine the real time state (speed, volume, congestion level, etc) of the transportation network
- Prediction – Aimsun - Models traffic management strategies, generates metrics
- Generate response plans



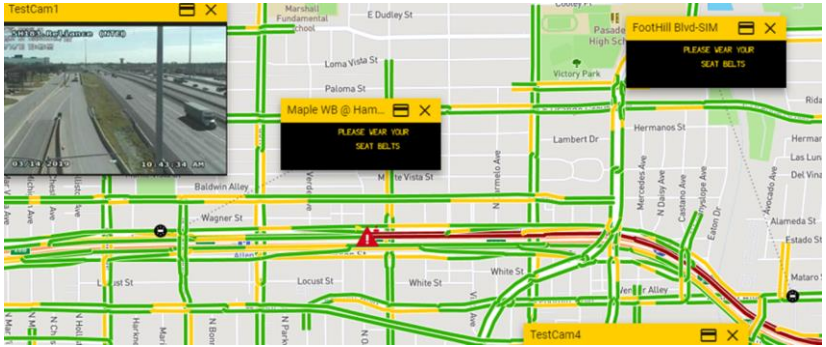
DSS Functions

- **Provide and evaluate response plans**
- **Provide one or more recommendations to corridor operators**
- **Provide recovery/termination plans**
- **Provide response metrics "Score Card"**

	Incident			I-210 EB @ San Gabriel																	
	Response Plan Evaluated			WB_Art_Foothill_Michillinda_SanGabriel 135																	
	Evaluation Period			13:15 - 14:00		45 min															
	Number of Simulation Runs			1																	
	Ramps		**Screenline**	**Travel Times**			**Stats - Area (Zones 3-4-5-6)**				**Stats - Fwy Mainline, HOV, Connectors** SR-134 or I-605 --> Off-Ramp Detour #1				**Stats - Detour #1** WB_Art_Foothill_Michillinda_SanGabriel				**Stats - Detour #2** None			
	Upstream Off-Ramps *vehs*	Dwnstrm On-Ramps *vehs*	*vehs*	Fwy Queue *min*	Detour #1 *min*	Detour #2 *min*	VMT *veh-mi*	VHT *veh-hrs*	Total Delay *veh-hrs*	VMT/VHT *mph*	VMT *veh-mi*	VHT *veh-hrs*	Total Delay *veh-hrs*	VMT/VHT *mph*	VMT *veh-mi*	VHT *veh-hrs*	Total Delay *veh-hrs*	VMT/VHT *mph*	VMT *veh-mi*	VHT *veh-hrs*	Total Delay *veh-hrs*	VMT/VHT *mph*
No-Response Scenario	7737	4610	7154	57.6	29.8	*Null*	160,886.0	7,558.3	4,834.9	21.29	28,495.0	2,692.4	2,303.5	10.58	1,658.9	326.9	27.0	5.07	*Null*	*Null*	*Null*	*Null*
Response Scenario	8162	4662	7496	55.5	19.5	*Null*	162,367.5	7,472.8	4,715.5	21.73	29,455.2	2,653.1	2,250.1	11.10	2,102.5	306.2	16.6	6.87	*Null*	*Null*	*Null*	*Null*
Change	425	52	342	-2.1	-10.3	0.0	1,481.5	-85.4	-119.5	0.44	960.2	-39.3	-53.5	0.52	443.6	-20.7	-10.3	1.79	0.0	0.0	0.0	0.0
Change %	5.5%	1.1%	4.8%	-3.6%	-34.7%	0.0%	0.9%	-1.1%	-2.5%	2.1%	3.4%	-1.5%	-2.3%	4.9%	26.7%	-6.3%	-38.3%	35.3%	0.0%	0.0%	0.0%	0.0%

Corridor Management System

- Vendor COTS system – (Currently working with Kapsch, Parsons and Telegra)
- Data Visualization – Map and chart based information on traffic strategies, network state and ITS element state
- Workflow – Provides methods for defining incidents/events and reviewing/approving traffic management strategies
- Strategy implementation – Communicates with traffic control systems to implement traffic management strategies using signals, ramps, signs, etc
- Possible IEN - In combination with the data hub may function as an IEN for regional areas



Platform - Cloud Deployment Strategy

- **Deployment Strategy**
  - Single code base, single deployment methodology, multiple deployments
  - Differences are in deployed components and configuration
  - Future proofing the hosting technology
  - Automated Deployment based on configuration files
- **Full automation of system deployment**
  - Networking
  - Security
  - Components
  - Configuration
  - Compute environment
- **Configuration files also permit the automatic restarting of processes that terminate for unplanned reasons**
- **Combined with cloud resources available on demand and automated testing, this results in fast and accurate installations, software fixes, and updates**

Installation Timelines

- Tuning, QA, of Data Hub, DSS, and CMS can be done in four months
- Standards for creation of network descriptions and rules. Network creation and test rules can be ready in three months
- Existing C2C interfaces can be working in one month
- Development of new C2C interfaces can be done in as little as four months (with full testing infrastructure in place)
- Response plan development, modeling, ITS element installation, etc. will add time
- Of course this is the technical side – the allocation of funding and stakeholder agreements operate on a different time frame

In Conclusion

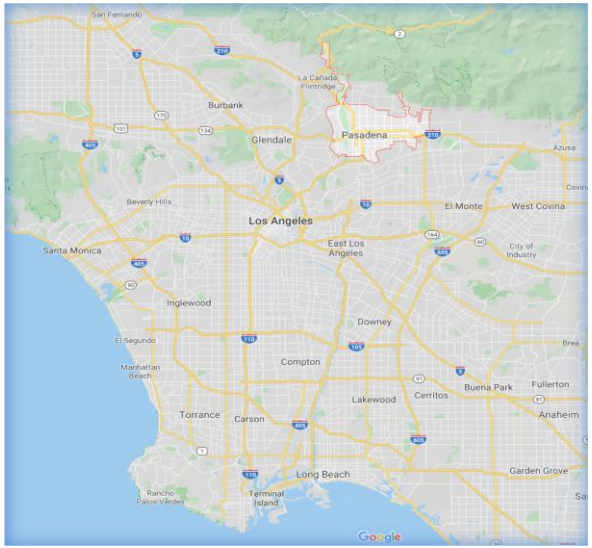
- **System is designed for:**
  - New Technology
  - Big Data
  - AI/Machine Learning
  - Ease of Installation
  - Reducing Costs
  - Raising capabilities of the transportation sector

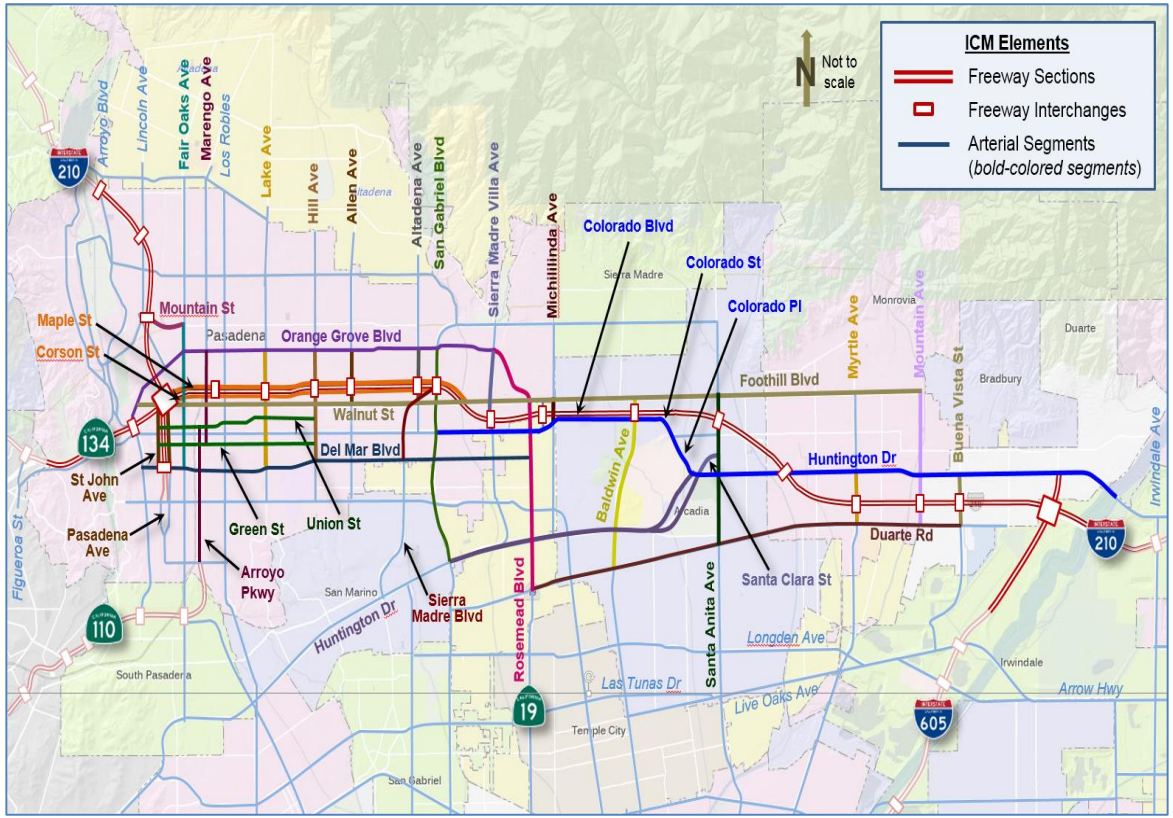
- **Designed to be:**
  - Multi jurisdictional
  - Repeatable
  - Resilient to failure
  - Extensible/expandable
  - Scalable
  - Secure

- **Reduce Stress ☺**

I-210 Corridor

Pasadena CA Northeast of Los Angeles



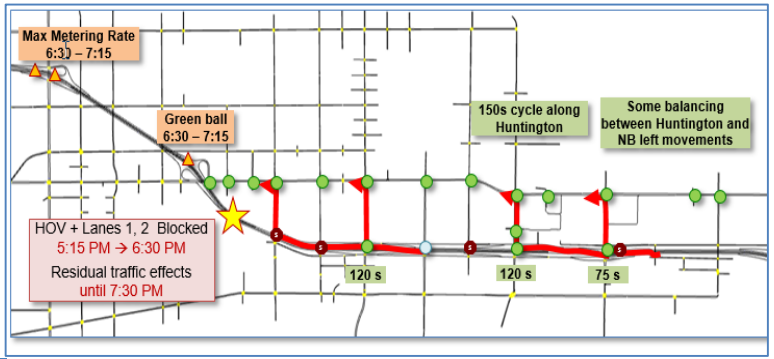


Data Hub, C2C, DSS and I-210 Pilot Schedules

- Data Hub and C2C Interface – Ready and Tested
- Pilot Corridor Management System Interface – Ready and Tested
- Decision Support Test System (DSS) – February 2020
- Rules Engine Cloud Implementation – September 2020
- I-210 Pilot Launch – April 2021

Benefits of Connected Corridors ICM

- ✓ **Benefits**
  - ✓ Queue reductions, various performance improvements including air quality
  - ✓ Improved planning and coordination
  - ✓ Changes in roadway operations to improve throughput and safety
  - ✓ Sharing of funds for greater impact
- ✓ **Example: April 25, 2017 incident on I-210 WB near Huntington off-ramp in the off-peak direction**



Simulated reduction in delays

- **Freeway and Huntington: - 313 veh-hrs** -13%
- **Entire corridor: -1058 veh-hrs** -2%

Simulated reduction in distance traveled (Reduced need to seek long detours around incident)

- **Entire corridor: - 2044 veh-miles**

Leveraging Connected Corridors for the Future

1. **Integrated Corridor and Regional Management System** – Expand on the rules-based engine and performance management-based DSS.
2. **Integrated Regional Mobility (IRM) Transportation Portal** – Provide regional partners (public and private service providers) with real-time situational awareness by integrating all relevant transportation modes, systems, and data and sharing it.
3. **Statewide Data Warehouse** – Create a statewide data warehouse with analytics and data mining applications to monitor and analyze statewide operations and system performance.
4. **Performance Measurement and Business Intelligence** - Transform data from the Statewide Data Warehouse (SDW) and/or Regional Data Warehouses (RDW) , into meaningful and useful information that can be used to develop more effective strategic, tactical, and operational strategies and decisions.
5. **Enhance Regional and Statewide Traveler Information Systems** – Share information with 511 regional systems and traveler information service providers via an open data portal application.
6. **Pilot Vehicle to Infrastructure Technologies and Strategies** - Communicating directly with vehicles via connected vehicles applications, providing travelers with relevant information including roadway conditions and operational strategies developed by the regional management systems.

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Planning Underway for Connected Corridors Expansion

ICM Deployments Currently Under Development

- **D12 Anaheim – Triangle ICM**
- **D3 Sacramento – US50 ICM**
- **D11 San Diego - I-805 south corridor TSMO Plan**
- **D12 L.A. - Metro Regional ITS/ICM Plan**
- **26 Additional Corridors Identified Statewide**

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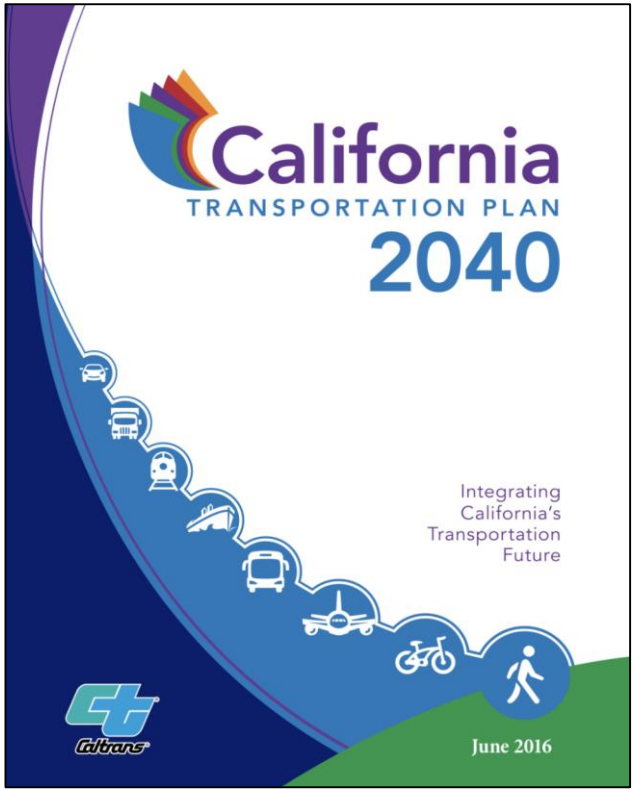
Commitment to Connected Corridors and ICM



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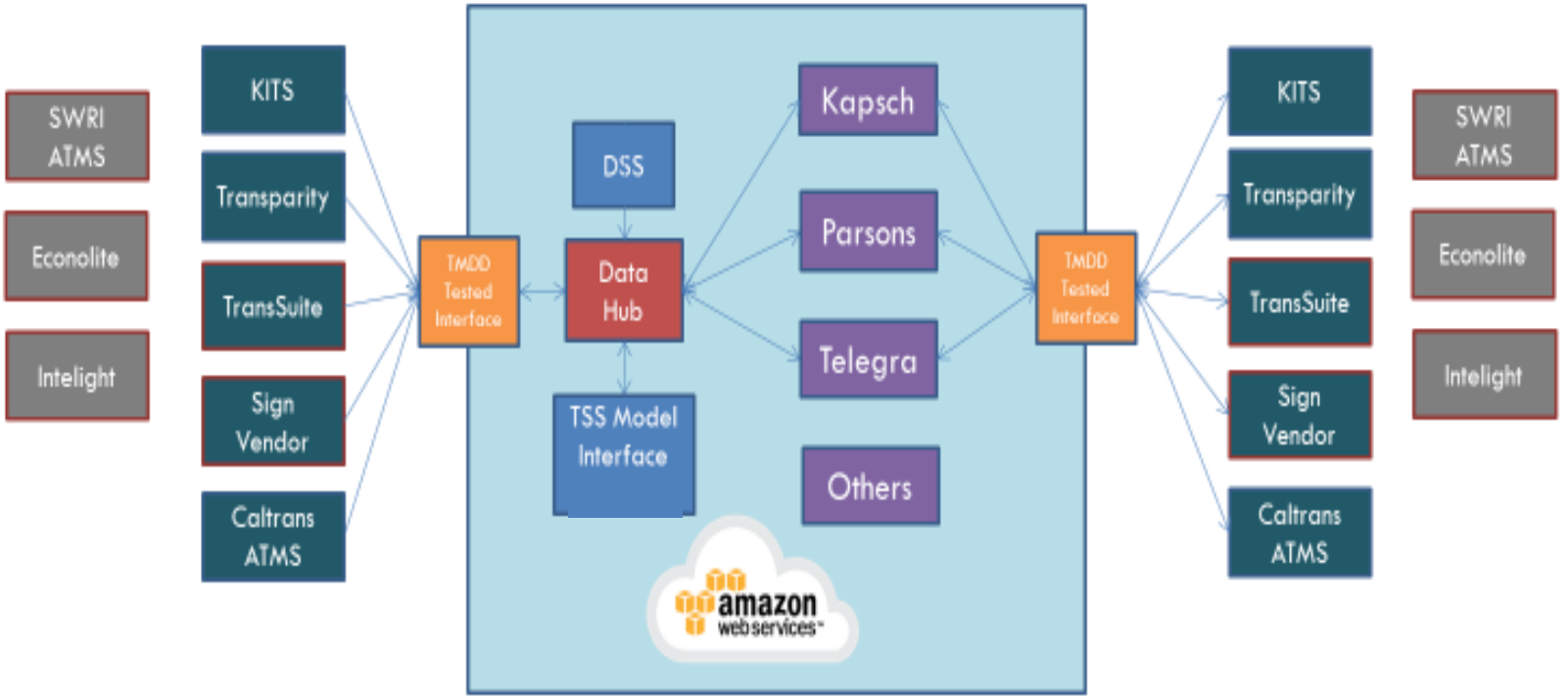
Connected Corridors Expansion Underway – D12

- ✓ Taking advantage of what is being built.
- ✓ Looking at it from a regional perspective rather than individual corridor.

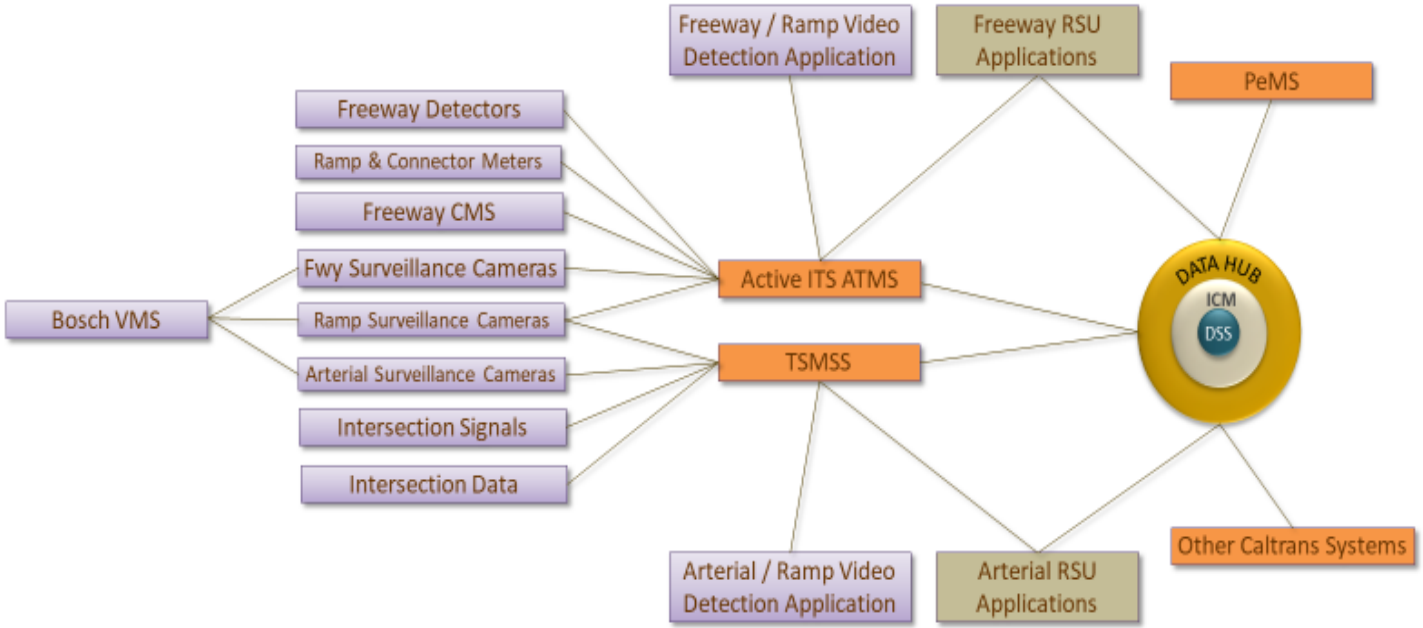
Caltrans District 12 – Expansion With New C to C Interfaces

- ✓ **Adding new standardized interfaces that can be used by others.**

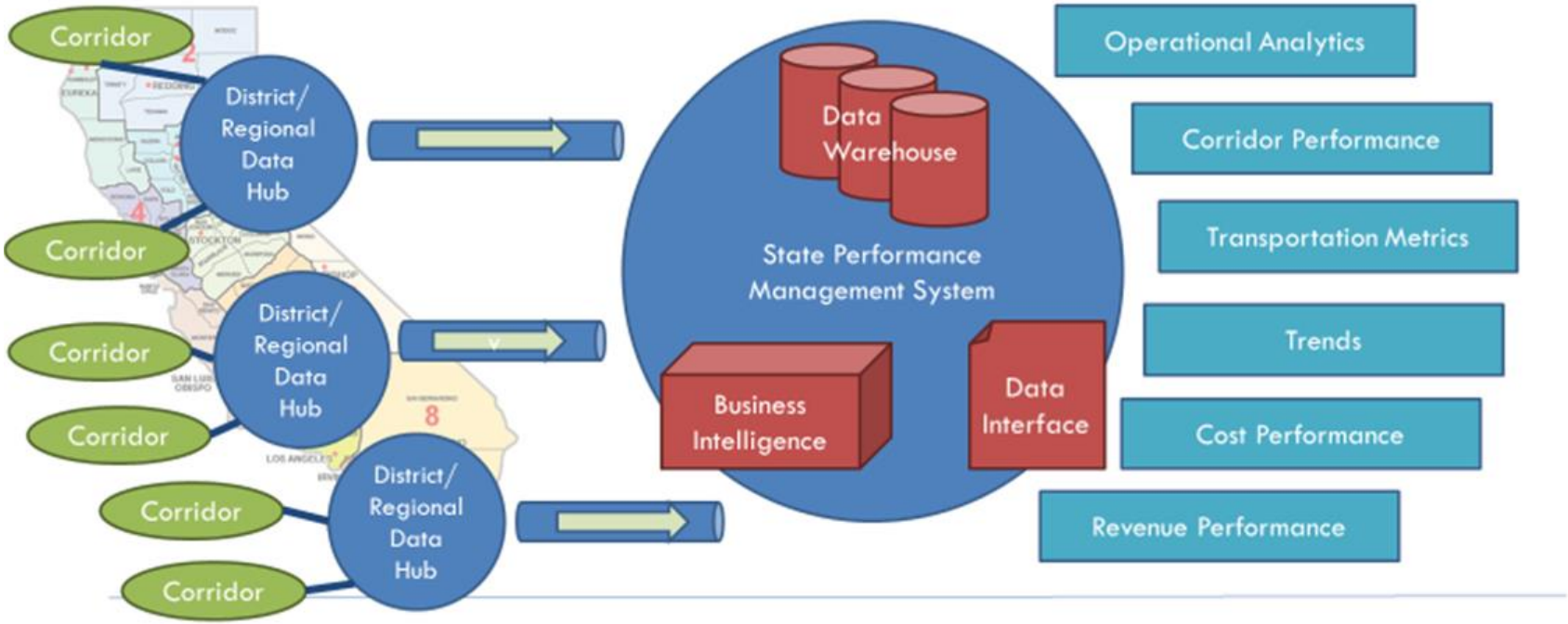


Caltrans District 12 – Expansion to Connected Vehicles and More

- ✓ **Adding connected vehicle infrastructure for both highways and arterials.**
- ✓ **Adding new data sources for freight and pedestrians and bicycles.**



State Consolidation of Data For Performance Measurement



FHWA 10 Attributes of a Successful ICM Site

INTEGRATED CORRIDOR MANAGEMENT (ICM)

10 ATTRIBUTES OF A SUCCESSFUL ICM SITE

ICM "Readiness"

- Recognizing existing infrastructure and systems for each modal network and identifying whether these can be effectively integrated into ICM
- Distinguishing whether existing transportation systems are being fully optimized
- Knowing whether the corridor contains alternative routes and modes for travelers
- Verifying that relevant agencies are in support of corridor operations

ICM attempts to help manage and control congestion on freeways and arterials by utilizing multimodal communication between transportation organizations and agencies. ICM can improve travel-time reliability and alleviate congestion by providing drivers and motorists multimodal traffic information to enable the most efficient and fastest means of transportation.

Prospective areas considering ICM must ensure that they are properly prepared to address implementation challenges. Dedicated coordination with local agencies and organizations is necessary to ensure that even the smallest details are not overlooked. For example, one agency upgrading software on a system may seem minute, but this can cause malfunctions in the system flow for partner agencies. These tasks are small but crucial in guaranteeing implementation success. In addition, communication and coordination between partner agencies is critical to ensure efficient operation of the system.

This fact sheet presents 10 attributes of successful ICM sites and describes their importance for effective implementation.

"In order to keep the economy moving, you have to keep mobility – keep goods, people, and services – moving. When the option was no longer there to physically expand our roadways, we had to turn to technology and ICM was the logical choice."

-Randy Iwasaki,
Executive Director, Contra Costa, Transportation Authority

"Caltrans is dedicated to the ICM project because it is critical to enhancing the livability of I-15 commuters. The project's success is due to collaborative, strategic partnerships of local, regional, and state agencies working in concert towards the common goal of providing network efficiency and reliability."

—Cory Binns, PE
Chief Deputy District Director, Caltrans District 11

"ICM is an information overlay. It's a coordination overlay, and it allows the individual pieces of the transportation system to be operated as more of a system."

—Jeff Lindley,
Associate Administrator, Federal Highway Administration

"ICM is really a concept that harnesses our newfound abilities to communicate better - to process big data, to coordinate existing assets - and bring it all together."

—Vince Valdes,
Associate Administrator, Federal Transit Administration

U.S. Department of Transportation

https://www.its.dot.gov/factsheets/pdf/ICM_10Attributes.pdf

For more information about this initiative, please contact:

Steven Mortensen, Federal Transit Administration | (202) 493-0459 | steven.mortensen@dot.gov
Neil Spiller, Federal Highway Administration | (202) 366-2188 | neil.spiller@dot.gov
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FHWA 10 Attributes of a Successful ICM Site

10 *Significant Congestion and Unreliable Travel Times*

The most critical—and obvious—attributes of a successful ICM site are noticeably high congestion and unreliable travel times. The impact of ICM is more noticeable in areas with significant congestion and delay, as improved traffic flow in these areas can be more attributable to ICM strategy implementation than in areas that experience inconsistent congestion.

9 *Infrastructural Availabilities*

ICM sites must also have the appropriate infrastructure in place to support ICM, such as parallel arterials and additional transit options. For ICM to work properly, there must be alternative means of transit to which people can shift based on the information and traffic data the system provides.

8 *Multimodal Capabilities*

ICM corridors must also have the ability to connect in a multimodal fashion. This means that the different transit organizations and agencies must be able to communicate with one another, such as bus transit, rail transit, high-occupancy-vehicle (HOV) lane management, etc. Full implementation is nearly impossible without open communication—both technologically and organizationally—between the different modes of transportation.

7 *Centralized Data Hub*

A localized transportation management center is critical for housing all communication and traffic data in one centralized location. This makes it easier to organize and analyze the different traffic data and information in a consolidated manner.

6 *Successful Procurement Practices*

The most successful ICM sites are able to identify the processes and practices that work, and the personnel needed to perform the job correctly and proficiently. For example, integrating traffic systems together requires a different set of skills and expertise than typical traffic engineering. Intelligent transportation systems (ITS) experts may need to be involved in the integration process to ensure it is completed effectively, and knowing this information in advance eliminates wasted time spent on troubleshooting. Efficient ICM sites are fully aware of expertise requirements and act accordingly during the procurement and integration processes.

5 *Readily Available Alternative Transit Options*

Alternative transit options are a necessity for successful ICM sites. These options could include bus rapid transit, HOV lanes, alternative commuter options, commuter rail, heavy rail (e.g., subway), and light rail. Effective ICM sites already have these options in place before ICM is implemented, and therefore can more easily integrate the options together.

4 *Optimization of Existing Transportation Systems*

Successful ICM sites are able to determine whether the currently existing transportation systems are being fully optimized to ensure that there are no additional underlying problems with traffic networks. For example, a site must verify that roads cannot be widened any more due to surrounding infrastructure or physical location, or validate that all additional alternative routes are being utilized in a manner that cannot otherwise be improved upon without ICM.

3 *Public Engagement*

Keeping stakeholders and the public engaged provides the public with better understanding of expected changes and better enables them to make more informed travel choices. A dedicated public-facing website that houses all of the corridor information and serves as a one-stop shop for project information can keep the public knowledgeable of recent ICM developments. It also provides the media access to all images and videos and reminds the public that the system is still in place—even after all physical changes and construction have been installed and forgotten.

2 *Open-mindedness for Change*

Change is not always easy. While some people are more susceptible to change, others may see it as a threat to the familiar routine and be less receptive. Successful ICM sites are able to encourage an open mind and acceptance to changing solutions for congestion and traffic. Encouraging the public to support the changes for the betterment of congestion and travel times is an extremely important—and sometimes difficult—task.

1 *Institutional Support*

One of the most critical pieces of successfully implementing ICM is interagency and institutional support. Without the coordination of transportation agencies and organizations, multimodal communication and coordination is extremely difficult. Deployment of the required ICM technologies can be severely delayed or even immobilized without the support of local and regional transit agencies and the ability to send information across jurisdictions. Strong leadership is also important. ICM implementation not only requires the coordination and support of external agencies and organizations, it also relies heavily on the ability to coordinate and make decisions from an internal perspective. Like most systems, ICM implementation can only fully succeed when all parties involved work together, and a strong sense of leadership is necessary to keep all of those aspects organized and the end goal on track.

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7 *Centralized Data Hub*

A localized transportation management center is critical for housing all communication and traffic data in one centralized location. This makes it easier to organize and analyze the different traffic data and information in a consolidated manner.

Benefits of Open Source and the Pool Fund Concept

EASE OF ADMINISTRATION

- ✓ No complex licensing – and no ongoing payments forever…
- ✓ No sole-source contractors or vendor-specific solutions
- ✓ No procurement contracts
- ✓ No fees for most current software updates

REDUCED COST

- ✓ Lower up-front costs (when using vendors with existing standard interfaces)
- ✓ Low cost implementations of improvements made by the community
- ✓ Increased standardized vendor system integration reduces the cost of implementing ICM
- ✓ Cost effectiveness increases as more agencies adopt the solution
- ✓ Reduces costs for the overall transportation industry when properly managed
- ✓ Permits new ideas and functions to be tested and implemented at a lower cost

GREATER ACCESS TO INNOVATION

- ✓ Able to leverage community improvements/updates and contribute to the community
- ✓ Attracts more people who want to help improve transportation and gives them a way to be involved
- ✓ Standardization of open source interfaces and reference implementations that others can use

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Thank You!

Questions?

Remaining Questions from the CHAT Box

Wrap Up

Meeting information & presentations will be posted to the I-95 Corridor Coalition website. Participants will receive a link to the presentations after they are posted.

Contact Information

I-95 Corridor Coalition

- Denise Markow, PE, I-95 Corridor Coalition, TSMO Director - dmarkow@i95coalition.org, 301-789-9088

Speakers

- Gene Donaldson, Delaware DOT - gene.donaldson@delaware.gov
- Nick Compin, California DOT - nicholas_compin@dot.ca.gov
- Joe Butler, University of California, Berkeley - joebutler@path.berkeley.edu

Poll Question #1 – ICM Implementation

1 Has your agency implemented ICM?

a. **Currently implementing ICM**
b. **Thinking about implementing ICM**
c. **Not currently planning on implementing ICM**

Poll Question #2 – Open Source Interest

2

Is your agency interested in participating in Open Source?

a. **My agency is interested in participating**
b. **My agency is not yet interested in participating**
c. **I am not sure if my agency is interested but we would like some more information about it**

Thank You!