

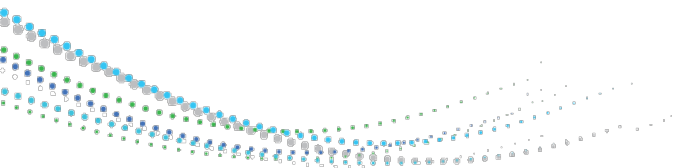


# MPOs: Preparing for Connected/ Autonomous Vehicles

November 16, 2016

# Agenda

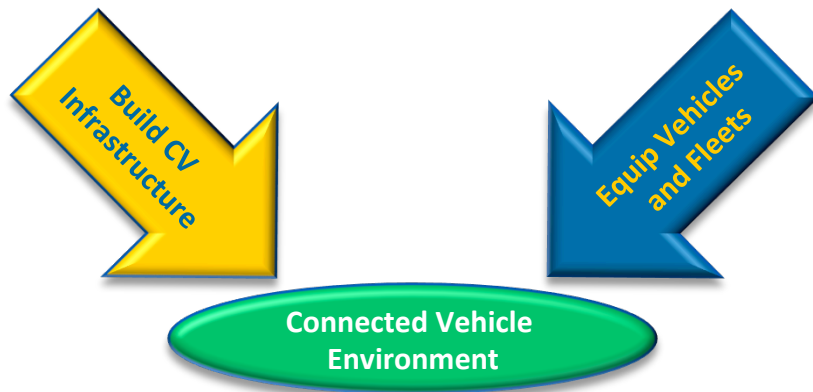
- The Connected Transportation World
- MPO's Role
- Actions to Take
- Benefits to be Realized
- Next Steps...





# It's all about Connectivity....

- Connected Vehicle Technologies promise major benefits in safety and mobility, while improving the Environment and the Economy
- Infrastructure and vehicles have to cooperate:



- What can an MPO's Role be?

# Barriers to Success: Silos

- Freeways
- Arterials
- Transit
- Airports
- Ports
- Rivers
- Health services
- Education services
- Energy
- Environment



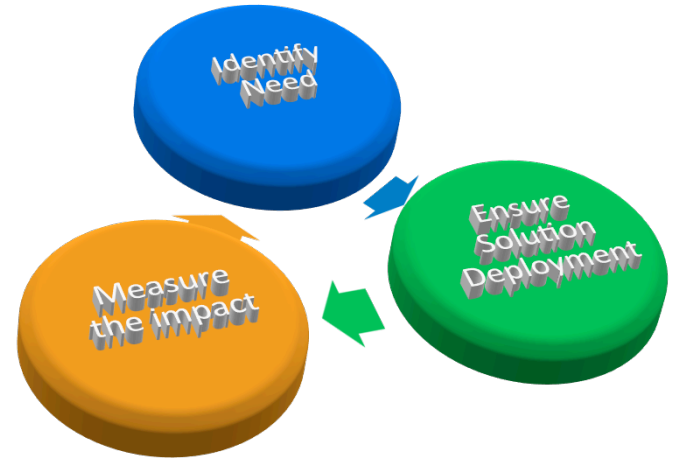
# MPO Role

- As a Regional Agency
  - Ensuring interoperability of applications across jurisdictional boundaries
  - Assisting Operating agencies in planning and deployment of connected technology
  - Promoting multi-modal and multi-jurisdictional solutions
  - Bridging the gap between local and national activities
  - Archiving, monitoring and assessing regional transportation mobility
- As an Operating Agency
  - Ensuring the use of CV technologies in MPO applications

Breaking Down Silos!

# Actions: Regional Agency

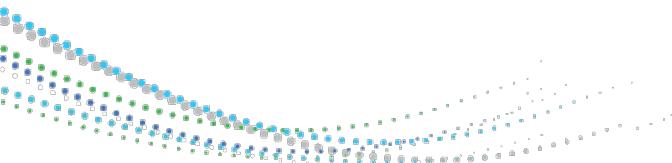
- The MPO needs to be in the loop of:
  - ☐ Identifying the need
  - ☐ Ensuring the deployment of solutions
  - ☐ Measuring the impact/benefit
- There needs to be a central transportation data hub for the region
  - ☐ To collect and feed data analytics (using real-time and historical data)
  - ☐ To produce actionable information for use by regional and local planning and operating agencies and private organizations supporting mobility services





# Actions: Operating Agency

- Develop a Strategic Plan for CV Deployment
- Adopt Agile techniques:
  - No extensive planning process and rigid “Roadmap” (the technology is changing too quickly)
  - Define Goals, a Framework and Need
  - Accommodate (Demand!) identification of short term application deployment for early results and lessons learned
  - Adapt the Plan if needed





# Regional Benefits

- MPOs can ensure a focus on region-benefiting corridor solutions and not just local projects
  - For example, use CMP analysis to prioritize corridors for action
- MPOs will be able to negotiate/partner with private sector services to:
  - Ensure social equity in mobility service provision
  - Mitigate the inherent conflict of public transit and private mobility service provision to ensure regional benefits
- MPOs can ensure that deployments follow the Regional ITS Architecture for maximum benefit through interoperable applications and equipment
  - Reduces both deployment and O&M costs



# Steps to V2I Deployment

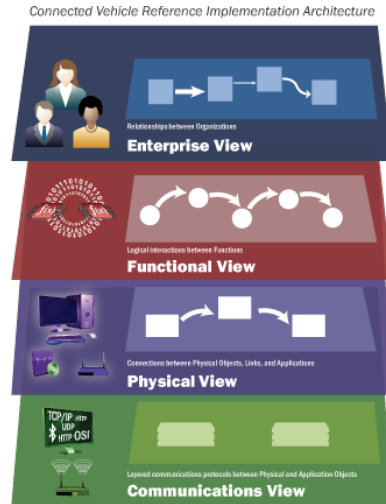
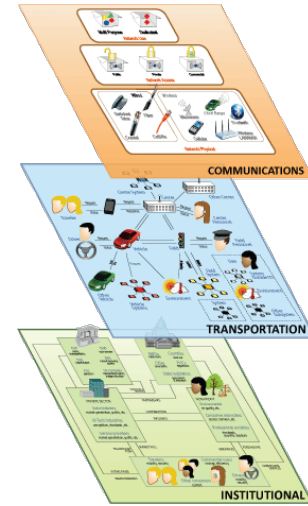
- CV V2I Deployment follows the same processes as ITS deployment
  - Needs Assessment
    - Look for needs that have been identified in Agency plans
    - Are any identified needs addressable by CV solutions?
    - Are other solutions more applicable to the needs than the CV solutions?
  - Identify candidate solutions/applications to pursue
  - CV Application Evaluation
    - Using the identified needs, evaluate the CV applications that are suitable
      - Cost-benefit information is minimal at this time
      - Recommend small pilot deployments to identify the costs and benefits

# Steps to V2I Deployment

- Develop an architecture which functionally describes the components, information exchanges and institutional relationships of the proposed solution(s) and the environment in which they will be implemented
  - Regional ITS Architecture should be updated to encompass ITS and CV
  - CVRIA can be used as a resource and the Systems Engineering Tool for Intelligent Transportation (SET-IT) software tool provides tailoring capabilities to define CV projects
  - CVRIA will be integrated with the National ITS Architecture by April 2017
    - Regional ITS Architecture support for CVRIA content will be available at that time
- Develop CV Strategic Plan

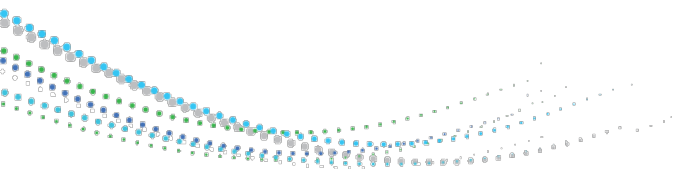
# Architecture

- Iteris is currently involved with ITS and CV architectures at the national, state and regional level
  - Developed and maintained National ITS Architecture since 1996.
  - Developed CVRIA and integrating it into National ITS Architecture.
- Architecture provides a functional framework supporting project planning in the context of an overall vision for ITS and CV in the region



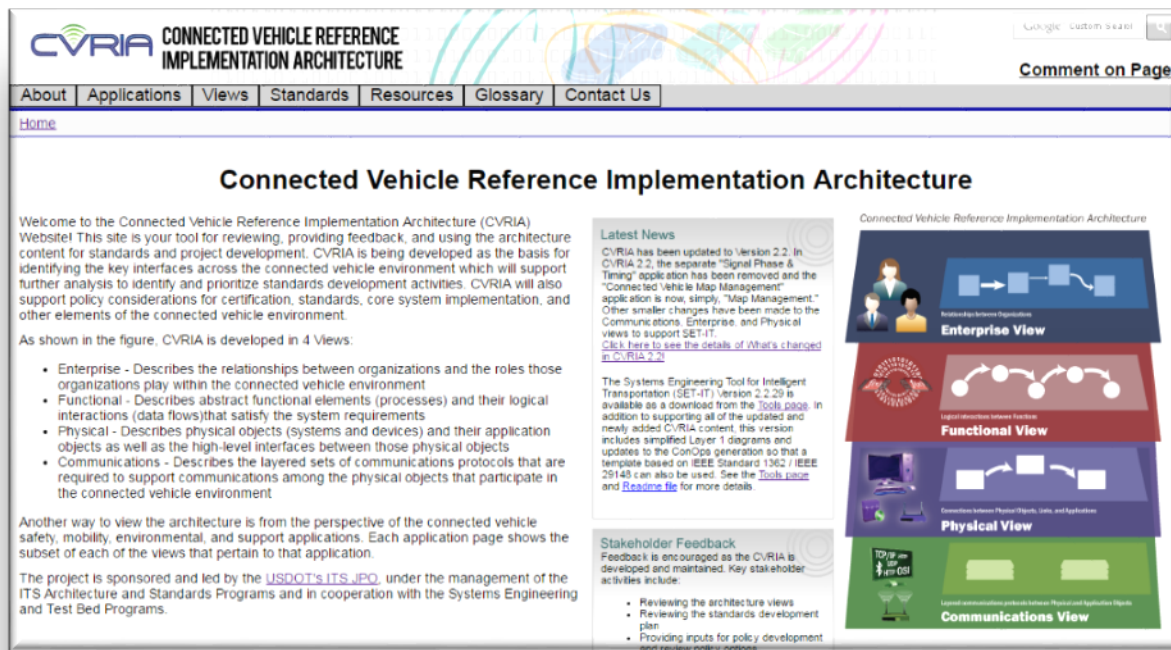
# CVRIA Website

- Organizes the architecture content in a layered hypertext format
- Allows for easy and quick targeted access to topics of interest
- Is updated as CVRIA evolves



# CVRIA Website Address

- <http://www.iteris.com/cvria/>



**CVRIA** CONNECTED VEHICLE REFERENCE IMPLEMENTATION ARCHITECTURE

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Home

## Connected Vehicle Reference Implementation Architecture

Welcome to the Connected Vehicle Reference Implementation Architecture (CVRIA) Website! This site is your tool for reviewing, providing feedback, and using the architecture content for standards and project development. CVRIA is being developed as the basis for identifying the key interfaces across the connected vehicle environment which will support further analysis to identify and prioritize standards development activities. CVRIA will also support policy considerations for certification, standards, core system implementation, and other elements of the connected vehicle environment.

As shown in the figure, CVRIA is developed in 4 Views:

- Enterprise - Describes the relationships between organizations and the roles those organizations play within the connected vehicle environment
- Functional - Describes abstract functional elements (processes) and their logical interactions (data flows) that satisfy the system requirements
- Physical - Describes physical objects (systems and devices) and their application objects as well as the high-level interfaces between those physical objects
- Communications - Describes the layered sets of communications protocols that are required to support communications among the physical objects that participate in the connected vehicle environment

Another way to view the architecture is from the perspective of the connected vehicle safety, mobility, environmental, and support applications. Each application page shows the subset of each of the views that pertain to that application.

The project is sponsored and led by the [USDOT's ITS JPO](#), under the management of the ITS Architecture and Standards Programs and in cooperation with the Systems Engineering and Test Bed Programs.

### Latest News

CVRIA has been updated to version 2.2. In CVRIA 2.2, the separate "Signal Phase & Timing" application has been removed and the "Connected Vehicle Map Management" application is now, simply, "Map Management." Other smaller changes have been made to the Communications, Enterprise, and Physical views to support SET-IT. [Click here to see the details of What's changed in CVRIA 2.2.](#)

The Systems Engineering Tool for Intelligent Transportation (SET-IT) version 2.2.29 is available as a download from the [Tools page](#). In addition to supporting all of the updated and newly added CVRIA content, this version includes simplified Layer 1 diagrams and updates to the ConOps generation so that a template based on IEEE Standard 1362 / IEEE 29143 can also be used. See the [Tools page](#) and [README file](#) for more details.

### Stakeholder Feedback

Feedback is encouraged as the CVRIA is developed and maintained. Key stakeholder activities include:

- Reviewing the architecture views
- Reviewing the standards development plan
- Providing inputs for policy development and review policy actions

### Connected Vehicle Reference Implementation Architecture

Relationship between Organizations

**Enterprise View**

Logical Interactions between Functions

**Functional View**

Connections between Physical Objects, Data, and Applications

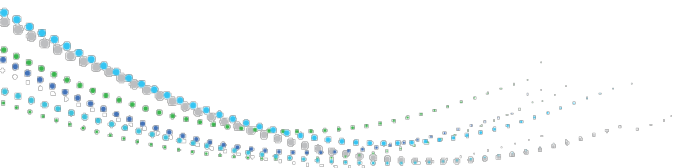
**Physical View**

Layered Communications protocols between Physical and Application Objects

**Communications View**

# National ITS Architecture and CVRIA

- CVRIA is being integrated with the National ITS Architecture
  - Available in April 2017
- New software tool set is being developed
  - SET-IT will be revised for ITS content to apply to project development
  - New software tool being developed to support regional ITS architecture development and maintenance for planning support
    - Replaces functionality found in today's Turbo Architecture software tool





# SET-IT

- Systems Engineering Tool for Intelligent Transportation (SET-IT)
  - ❑ Purpose: Develop project architectures for pilots, test beds and early deployments of connected vehicles
  - ❑ Applies CVRIA – build project specific architectures based on a common reference
    - Take advantage of prior research, updated with CVRIA
      - Over 90 connected vehicle applications
    - Establish common language between deployers, developers, stakeholders
    - Drawings and database definitions organized into one framework
    - Document generator builds Concepts of Operation using data and diagrams
  - ❑ Start with CVRIA and customize it with your names for Elements and Stakeholders
  - ❑ Available for free download from CVRIA website

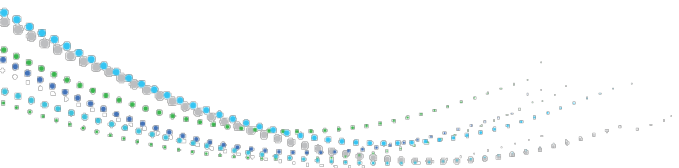


# CV Strategic Plan

- Documents needs, goals and objectives
- Documents CV architecture and specific CV application
- Provides projects for deployment of each CV application
  - Cost estimate for each project and application (capital and O&M)
  - Funding strategies
  - Performance metrics
  - Identify stakeholders and needed partnerships
  - Phase projects over
- Incorporate deployment plan projects in transportation plan
- Begin Systems Engineering process for each project as funded

# Deployment Considerations

- CV Project deployments will require the availability of supporting systems such as security and credentials management which may be provided by external service entities.
- V2I deployment should consider temporal availability of connected vehicles at levels sufficient to support application effectiveness.
- CV and V2I deployments should be developed using appropriate CV and V2I interface standards, some of which are in development.

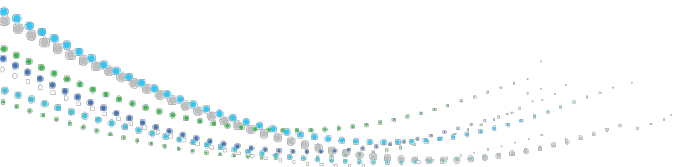


# Deployment Considerations

- Communications approaches
  - Safety applications - DSRC is needed
  - Mobility applications – Cellular or other wide area wireless should be considered
- Transition period between now and CV market saturation will require existing ITS equipment and CV equipment to support a mixed vehicle fleet
  - Increased operations and maintenance cost
- Autonomous Vehicle (AV) fleets can be considered as closed environments affording CV equipment deployment
  - ☐ Public agency consideration of AV includes roadway marking and signage maintenance in support of AV sensor technology

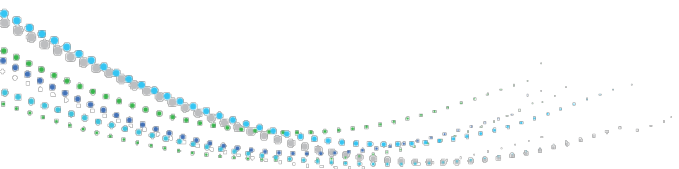
# Early CV Ideas

- Controlled fleets such as transit, emergency, and freight provide early mobile-side V2I equipment platforms that support signal priority or preemption and make use roadside V2I deployment
- Public Sector data collection and dissemination will evolve as vehicle fleet CV conversion escalates
  - Investments in vehicle detection and signage will be needed during the transition period.
  - How traffic control systems obtain vehicle data will change.
  - How motorists become informed will change.



# Funding Strategies

- Same funding sources for ITS are available for CV
- FAST Act established new grant funding opportunities
  - Advanced Transportation and Congestion Management Technologies Deployment (Section 6004)
    - \$60M of federal grants available per year
- USDOT intends to pursue a second round of CV Pilot Deployment projects in 2017



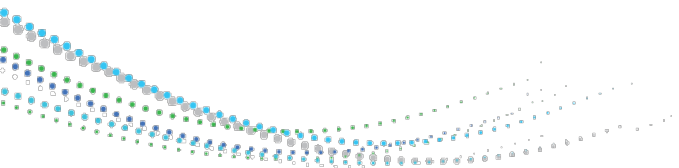
# Other Considerations

- Digital Infrastructure: Deploy telecommunications networks using industry standards to support interoperability
- Data Capture & Exploitation: CV's will generate an enormous amount of data for Agencies to improve planning and operations.
- Infrastructure: How will your existing infrastructure accommodate CV technology? What is the approach for upgrading/replacing infrastructure?
  - There will be a transition period when old infrastructure is maintained while new CV capable infrastructure is deployed. Cost savings will be postponed.
- Cyber Security: Security threats are real. Protection of assets needs to be factored into costs.
- Security and Credentials Management is required
  - Trust in data exchanges is mandatory for CV to work
  - Decisions on how Security and Credentials management will be provided nationwide is being defined
- Partnerships: Public-private partnerships are encouraged.



# How To Move Forward

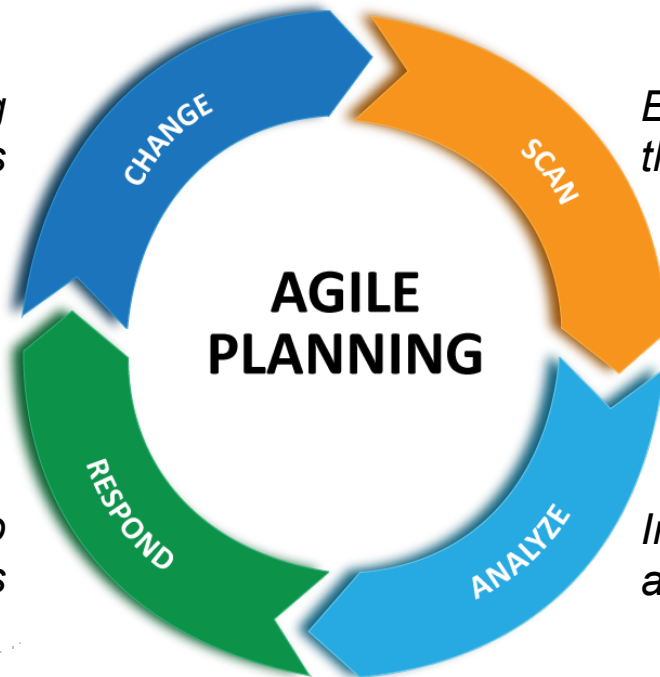
- Educate yourselves about CV and Smart Cities
- Develop a needs-based architecture and CV Strategic Plan
- Deploy project quick wins and pilot projects
- Participate in any regional, comprehensive CV, AV, Smart Cities plans
- Do not be paralyzed into inaction but be patient knowing that the CV environment depends on many stakeholders who may not move forward with their part of the system at the same pace.



# Next Steps...

- Create an Agile Plan - document but not overkill

*Influencing and shaping  
future environments*



*Early warning-scanning  
the emerging trends*

*Responding to  
opportunities and risks*

*Information led decisions  
and solutions*

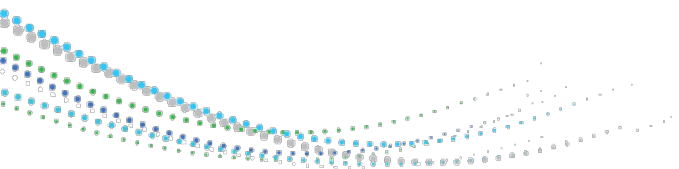
# Next Steps...

- Corridor Improvements
  - Identify CV pilot projects based on:
    - Degree of Need
    - Level of instrumentation
    - Openness of stakeholders
  - Select technologies for pilot deployments
  - Deploy in small areas at first followed by increasingly larger deployments later
  - Measure performance and analyze effectiveness
- Update the CV Strategic Plan and repeat the process

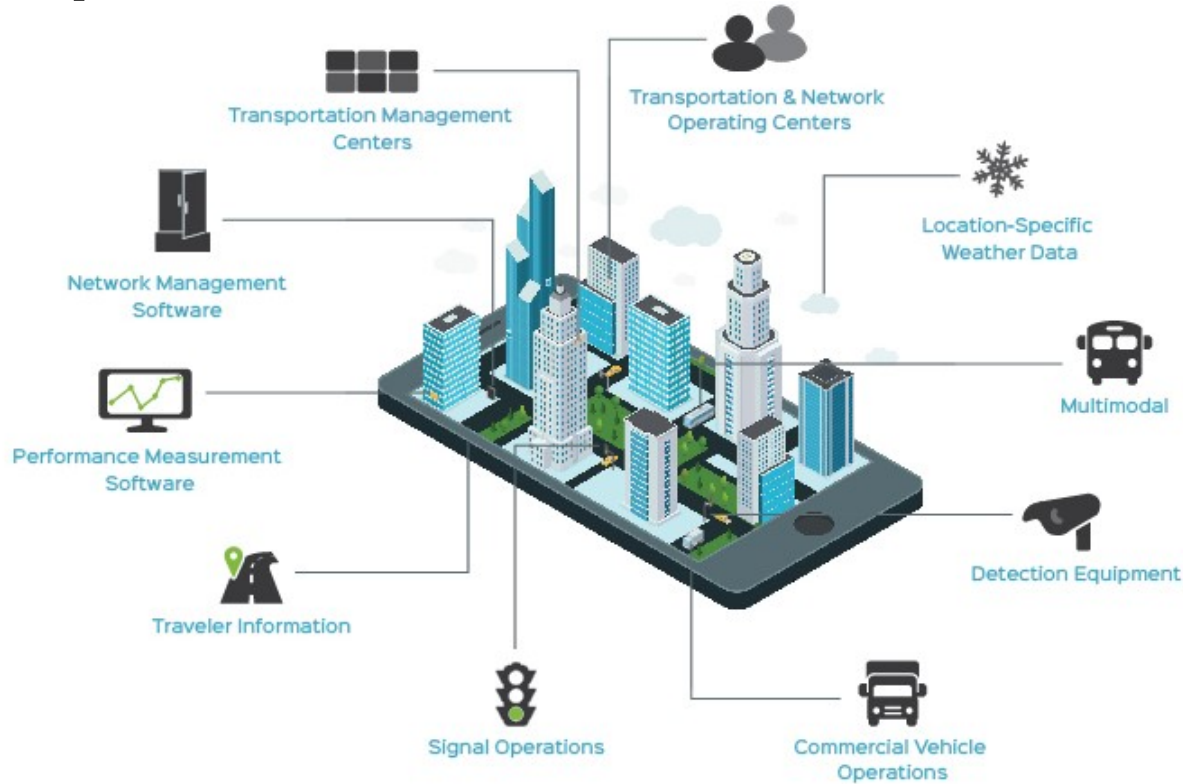


# Iteris Project Experience

- National ITS Architecture
- Connected Vehicle Reference Implementation Architecture (CVRIA)
- SET-IT: Systems Engineering Tool for Intelligent Transportation
- Southeast Michigan Project Connected Vehicle Architecture Development
- Connected Vehicle to Infrastructure Cybersecurity Project
- VDOT CV Test Bed Systems Integration



# The Iteris Experience in a Connected Transportation World



# Thank You!

Questions?

