



ITERIS CONNECTED VEHICLES TECHNOLOGY EVALUATION

Since 1996 Iteris has been privileged to assist the United States Department of Transportation (USDOT) with evaluating advanced transportation technologies. Beginning with the original development of the National ITS Architecture and continuing with the recent release of the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT). ARC-IT fully integrates connected vehicle and traditional intelligent transportation system capabilities in detail. At its core, the work on the ARC-IT involved researching the numerous Connected Vehicle and related applications to determine the needs that each addressed and the requirements they imposed along with potential benefits to public safety and transportation operations.

We are actively
involved in

3 CONNECTED
VEHICLE
test facilities

Development of the
Connected Vehicle
to Infrastructure
architecture since

2012

2017 Iteris is combining
the National ITS Architecture
with Connected Vehicle Arch

Given the role that a county or regional agency plays in a region, it is crucial to know how to prepare for the CV Environment and how to prioritize the needed investments to support such advances in technology that are evolving rapidly.

For regional planning, steps to deployment will include the following:

- ▶ Identification of transportation needs and appropriate deployment opportunities;
- ▶ Development of a regional plan or framework that illustrates existing systems and addresses how new capabilities satisfy existing and anticipated needs.
- ▶ Development of institutional awareness and local or regional support around a common framework or regional plan;
- ▶ Potentially conducting pilot projects to demonstrate viability and to determine benefits;
- ▶ Development of specific projects harvested from the transportation plan and phased based on financial constraints, integration dependencies and temporal requirements; and
- ▶ Development of system design and procurement approaches following appropriate Systems Engineering processes.

The process by which CV infrastructure and applications are deployed is similar to that for other transportation infrastructure and is generally viewed as an extension of existing ITS practices. The primary distinction is that a successful, connected vehicle system requires a cooperative deployment of the mobile infrastructure (vehicles, pedestrians, bicycles, etc) that also participate in and support the applications— that is generally outside the control of the agency deploying the infrastructure.

Iteris has developed a methodology to understand and evaluate technologies based on regional transportation needs as follows:

- ▶ **Categorize** the CV applications that address the region’s transportation needs based on:
 - The **application groups** (e.g. V2I safety, V2V safety, agency data, mobility, etc.)
 - The **application bundles** (e.g. Multimodal Intelligent Traffic Signal Systems (MMITSS), Integrated Network Flow Optimization (INFLO), Response, Emergency Staging and Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.), etc.)
- ▶ **Evaluate** the CV applications
 - Using the **sources** such as Concept of Operations, System Requirements, Impact Assessments, Prototype/Demonstration, Deployment Plans, as well as portals such as Open Source Application Development Portal (OSADP) and Research Data Exchange (RDE)

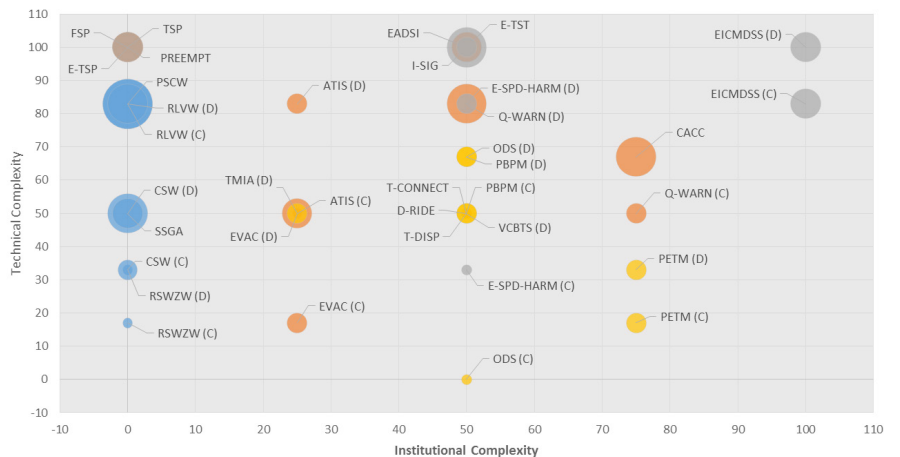
Integrating
Smart
Transportation
Communication
Systems and
connected
Mobility Since
1998

iteris
collects &
processes
500+
TB DATA
annually

- Looking at **categories** such as backhaul communication/restrictions, mapping support, expected latency, data needs from OBUs, data needs from RSUs, etc.
- ▶ **Quantify** the scores associated with the CV applications
 - Using the complexity scores developed by three high-level concepts – Institutional, Technical and Risk

Using the above methodology, Iteris has developed a CV application complexity scoring system. The figure below illustrates how the categorization has been used to depict the deployment complexity of the selected applications. The deployment aspects were assigned scores with higher number indicating an increased level of deployment complexity. The scores are determined based on three major categories of institutional, technical, and risk factors. The plotted graph has Institutional complexity along x-axis, Technical along y-axis, and Risk represented by the size of the bubble.

CV Applications Complexity Scoring



- | | |
|--|---|
| (C) – Cellular | (D) – DSRC |
| ATIS - Advanced Traveler Information System | CACC - Cooperative Adaptive Cruise Control |
| CSW - Curve Speed Warning | D-RIDE - Dynamic Ridesharing |
| EADSI - Eco-Approach and Departure at a Signalized Intersection | E-SPD-HARM (D) - Eco-Speed Harmonization |
| EICMDSS - Eco-Integrated Corridor Management Decision Support System | E-TSP - Eco-Transit Signal Priority |
| E-TSP - Eco-Traffic Signal Timing | FSP - Freight Signal Priority |
| EVAC - Emergency Communications and Evacuation | I-SIG - Intelligent Traffic Signal System |
| ODS - CV-enabled Origin- Destination Studies | PBPM - Probe-based Pavement Maintenance |
| PETM - Probe-enabled Traffic Monitoring | PREEMPT - Emergency Vehicle Preemption |
| PSCW - Pedestrian in Signalized Crosswalk Warning | Q-WARN - Queue Warning |
| RLVW - Red Light Violation Warning | RSWZW - Reduced Speed Work Zone Warning |
| SSGA - Stop Sign Gap Assist (V2I Only) | T-CONNECT - Connection Protection |
| T-DISP - Dynamic Transit Operations | TSP - Transit Signal Priority |
| TMIA - CV-enabled Turning Movement & Intersection Analysis | VCBTS - Vehicle Classification- Based Traffic Studies |

This V2I review provides a broad analysis of V2I technologies and their application in a regional environment. Iteris has also developed a “maturity” model to determine application readiness for deployment, and those that are of interest to an agency. Using this information, Iteris can then carry out an assessment of the applications to recommend and advise what role, or roles, the agency should take in advancing the development and deployment of each application based on the needs of the region.