Workshop Detailed Summary: Appendix B

Enhancing Interoperable Connectivity for Safe Transportation:
Continuing The Momentum Toward National Deployment

U.S. Department of Transportation

Activity Area/ Timeline	Notes	2023	2025	2030	2040	Importance (in attendee votes)
Roadside Unit (RSU) Installations - Intersections, Corridors, etc. *(Ranked #1/15)*	• Requires a consistent system design • U.S. Department of Transportation (U.S. DOT) funding to develop standard: Infrastructure Owner Operators (IOOs) need this to move forward • Should be one party certifying (or consistency across certifying agencies) to ensure that the RSU product meets standards. The certification should mean all equipment will talk to each other. • Stable sample procurement (there is an RSU standard and control standards, but no sample spec) • Change from "RSU" to "infrastructure installations"	• Individual state deployment plans approved by end of year (EOY) • National deployment plan approved by EOY • Replace 10% of deployed RSUs • Funded deployment • Understand the need for standards and standardize RSUs by end of 2023 • Improve MAP workflow	**2024:** • Transition existing Dedicated Short Range Communications to Long Term Evolution (LTE)-Vehicle-to-Everything (V2X) • Test 3 or 4 RSUs with major on-board units (OBUs) for interoperability by U.S. DOT **2025:** • 5% to 30% of intersections • 75% connected and 10% non-connected at at-risk intersections • Prioritize intersections with high rates of accidents • Combine with electric implementation • Signal Phase and Timing (SPaT) and MAP available on 5.9 gigahertz (GHz) at 20,000 intersections • Identify corridors needed	**2028 / Year 5:** • 100,000 signalized intersections (35% large, 25% midsized, 8% rural) • 100% new build • 2030: • 25% to 90% of intersections • Nationwide infrastructure deployment (as opposed to local or state), highway corridors	**2033 / Year 10:** • 250,000 intersections (85% large, 60% midsized, 20% rural) **2040:** • All remaining intersections and priority areas equipped	38

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Demonstrated interoperability: *** LTE-V2X to LTE V2X** *** Comms inside 30 megahertz (MHz) to comms in other spectrum** *** Security credential interoperability** *** Application interoperability**	• Who is working on interoperable security? • Apps don't need interoperability separate from messages. The apps on receiver are proprietary. • Why not Cellular (C) V2X? Human Machine Interface alert? • Be equipment agnostic • Demonstrated standard/certification testing • Coordinated city protocols • Roadway classification-specific interoperability • Application Programming Interface geographically aware and tolerant of older versions • Awareness of what data frame the OBU / RSU is expecting • Replace LTE with 5G • Add Security Credential Management System (SCMS)	• Demonstrate a minimum of 3 device suppliers in market • Message interoperability by EOY	• Demonstrate at least 10 device suppliers in market • Message interoperability performance improved • Evaluate increased spectra allocation • Use-case/application interoperability testing • Common interoperable set that can be used by all: SPaT, Institute of Electrical and Electronics Engineers, Society of Automotive Engineers (SAE), SCMS, MAP	• Demonstrated interoperability 2026-2028 *given production timeline		17

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Technology Stability: Standards and Certification Tests *(Ranked #3/15)*	• What will be the new test certs and when available? • What is the capacity of the agency to maintain? • Performance to expected levels • Anticipate guard band req's from the Federal Communications Commission (FCC) Apps on 20MHz	• Standards and performance tests (Awareness apps) • Begin testing on CV2X 5.9GHz in urban scenarios • Begin testing on how many connections can be maintained with 1 RSU in dense urban areas	**2024:** • Harmonized available global standards for U.S. **2025:** • Complete SAE Connected Intersection Standards development	• Industry consensus on how lower layer protocol evolution will be achieved: — 4G indefinitely? — 4G -> 5G? — 4G -> 6G in 203X? — Different approaches for different apps?		22.5
Security Policies and/ or Operational Functions	• Who provides support to RSU and how do stakeholders communicate?	• Self-certification • SCMS certification policy accepted by stakeholders • Determine security orchestrator in Internet of Things (IoT) scenarios with diverse vendors (city, private operator, etc.) • New security policies / operation function used by all. Bake security in as early as possible to secure communication.	**2024:** • SCMS governance **2025** • Extend to SCMS		• Full third-party certification	13

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V2X Enabling Messages (Basic Safety Messages (BSMs), SPaT, MAP, Radio Technical Commission for Maritime Services, etc.)	• Add Personal Safety Message J2945/9	• Begin standardization of traveler information	• SPaT, MAP, and BSM part 1	• BSM part 2		5
V2X Applications		• Prioritize list of safety use cases for LTE vs. 30 MHz • Validation tests defined for Vehicle-to-Infrastructure • Original equipment manufacturers (OEMs) adopt valid process / policy • Signal based apps • Customer perceived value	• All new RSUs deployed at intersections are validated • V2X apps validated • Red light violation warning, eco driving, pedestrian in crosswalk, queue warning, work zone warning • Environmental license/ approval of OBUs connecting to on-board diagnostics port • Follow Architecture Reference for Cooperative and Intelligent Transportation 9.1 for development and market ready milestones	• Transit signal priority (TSP), freight signal priority, Emergency Vehicle priority (EVP), vehicle rerouting, incident detection	• Automated continuous monitoring of validated intersections	10

Activity Area/ Timeline	Notes	2023	2025	2030	2040	Importance (in attendee votes)
Public Fleet Deployments *(Ranked #2/15)*	• TSP, EVP priority • Apply BIM among public safety via V2X • Schedule adherence for transit	• LTE 25% • 6,000 public fleet vehicles • Multi-stakeholder (IOO & OEM) definition of what messages are needed for deployment • Traffic signal preemption/priority for transit vehicles	• LTE 50% • 20,000 public fleet vehicles • National procurement of aftermarket OBUs for use in public fleets	**2027:** • Expand public fleet deployment **2028:** • LTE 75% • 30 MHZ 25% • Aftermarket deployment in 20% of vehicles **2030:** • 30 MHz 50% • Public education and explaining the benefits • Mix of cloud and physical deployment	• 30 MHz 75%	32

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Private Fleet Deployments	• Rental fleets	• 1,000 private • LTE 25% • Aftermarket OBU adopted & large-scale deployment • Signal priority for freight vehicles, non-emergency medical transport	• LTE 50% • Large scale deployment of aftermarket OBUs & measure return-on-investment • Aftermarket deployment in 10,000 vehicles	**2028:** • LTE 75% • 30 MHZ 25% **2030:** • 30 MHz 50% • Aftermarket deployment in 200,000 vehicles • OBU is standard option on any fleet vehicle • Insurance companies reject vehicles without OBU	• 30 MHz 75% • Autonomous fleets • V2X safety integrated into on-board driving system	10
Vulnerable Road User Vehicle Deployments (e.g. Bicycles, Scooters, Wheelchairs, etc.)	• Need to focus on what use case is possible • Detection and classification of ped movements • Use common Artificial Intelligence model for detection among vendors • Wheelchairs, peds • Passive only (equity issues)	• High priority piloting stages	• Bicycles	• Scooters		8

Activity Area/ Timeline	Notes	2023	2025	2030	2040	Importance (in attendee votes)
OEM Equipped Passenger Vehicles & Safety Applications	• Same timeline as IOO	• Commitment to volume deployment • Define a small set of critical use cases that will be developed with support from U.S. DOT/ OEMs • Announce incentive for OEMs to deploy • Follow up with OEMs to announce deployment by mid-2024	• "Early adopter" OEM launch • OEMs representing 25% of U.S. market announce intent to start deployment by 2028 • Deployment based on previous commitments • OEMs include OBUs off production line • Limited field testing by U.S. DOT with vehicles of major OEMs • OEM production vehicles alert drivers based on intersection data	**2027:** • Provide future mandate for CV2X in all vehicles • Voluntary CV2X deployment **2028:** • OEMs representing 50% of U.S. market start to deploy by 2028 or announce intent to start deployment by 2031 **2030:** • "Wait and see" OEM launch • 90% of all newly manufactured vehicles • All vehicles come to market equipped and accept validated messages • All vehicles on the road are connected	• "Only if mandated" OEM launch	18
Aftermarket Safety Device (ASD) Equipped Passenger Vehicles & Safety Applications		• Subsidies for ASDs				5

Activity Area/ Timeline	Notes	2023	2025	2030	2040	Importance (in attendee votes)
Develop Use Case Marketing Materials	• General public different than state DOTs	• Continuous from 2023 and beyond	**2024:** • "Marketing materials" that describe reasons local agencies should deploy CV2X			5
Policies and Guidance		• U.S. policy on security widely accepted • FCC issue CV2X waivers by May 2023 • Identify V2X deployment funding sources and unmet funding needs • Finalize roadmap for U.S. DOT • ITS America National V2X Deployment Plan • IOO implementation and deployment plans	**2024:** • Follow up with FCC to issue Notice of Proposed Rulemaking by 2024 **2025:** • U.S. National Highway Traffic Safety Administration New Car Assessment Program inclusion • Tax incentives (OEM side) • Second Report & Order	• U.S. mandate • 50-State Milestone • Subsidize OBUs to achieve universal adoption		9.5
Technical Assistance and Workforce Development Resources	• Sustain a qualified workforce, who certifies them? International Municipal Signal Association? ITS America?	• Share the Connected Vehicle (CV) Pooled Fund Study connected intersections guidance document broadly (and the MAP guidance doc) • Work Zone (WZ) (CV2X) - WZ digital alerts, smart WZ specs	**2024:** • Assistance and workforce development plans			2

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Anything Else?	• Driver education • 5- and 10- year plan like ITS America Plan • Public Outreach and Comms Plans • A priority to come up with the beginnings of ITS America's estimated deployment	• Dedicated pot of funding to V2X infrastructure (not grants) • Ride hailing • Vehicle-to-device	• U.S. DOT facilitated education between OEMs and U.S. DOT (i.e., Traffic Signals 101) • Standard process for certificates	• Commercially available CV apps so IOOs don't have to develop their own		11


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