USDOT Updates: CV Pooled Fund Study Meeting

April 30, 2024

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Agenda

1. National V2X Deployment Plan
2. V2X Accelerator NOFO
3. Grants to Accelerate V2X Deployment
4. FCC Update
5. V2X Training and Other Technical Assistance Resources

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Accelerating V2X Deployment – Listening Session

John Harding (FHWA)

Govind Vadakpat (ITS JPO)

April 2024

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Purpose

The purpose of today's Listening Session is to:

- provide an update on DRAFT National V2X Deployment Plan activities.

- summarize stakeholder feedback received on the DRAFT National V2X Deployment Plan.

- discuss Deployment Plan companion document structure.

- discuss next steps for accelerating the deployment of V2X.

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National V2X Deployment Plan Process

1st V2X Summit:

(August 2022)

Requested by stakeholders after FCC court ruling limited the use of certain V2X technologies. USDOT committed to taking action and shared research updates

2nd V2X Summit:

(April 2023)

Gathered feedback to draft a national V2X deployment plan

3rd V2X Summit

(October 2023)

Unveiled the draft **National V2X Deployment Plan** - outlines strategic goals and targets to accelerate nationwide V2X deployment

Video – Secretary Buttigieg Announces the Draft National V2X Deployment Plan

Key Plan Components
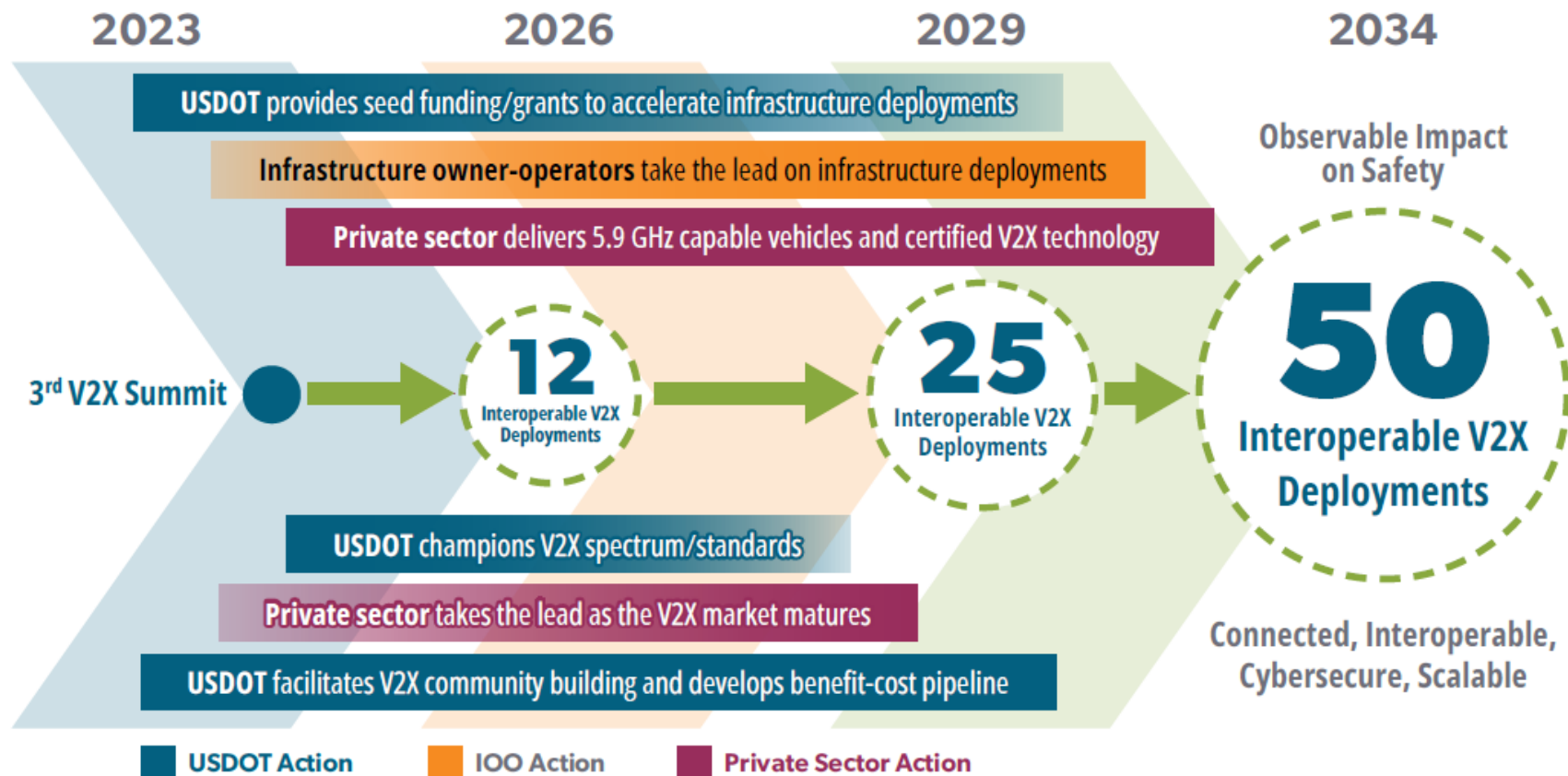
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Stakeholder Involvement

Achieving a national, interoperable transportation system requires *collective action* from both public and private sectors.
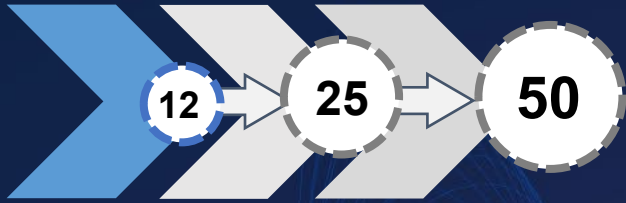

Federal Agencies
- USDOT
- FCC
- NTIA

Automotive Industry
- OEMs
- Automotive suppliers

Deploying Agencies
- Transit operators
- Freight operators
- States, local governments, tribes, and public agencies

Support Services
- App developers
- Service providers
- ITS equipment / software vendors
- Design / integration / deployment consultants
- Security credential providers
- Communications providers

Professional Associations and Organizations
- Test certification providers
- Standards development organizations
- Trade and industry associations

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Creating Momentum Through Coordinated Stakeholder Actions

2023 — 2026 — 2029 — 2034

USDOT provides seed funding/grants to accelerate infrastructure deployments

Infrastructure owner-operators take the lead on infrastructure deployments

Private sector delivers 5.9 GHz capable vehicles and certified V2X technology

3rd V2X Summit

12 Interoperable V2X Deployments

25 Interoperable V2X Deployments

50 Interoperable V2X Deployments

Observable Impact on Safety

Connected, Interoperable, Cybersecure, Scalable

USDOT champions V2X spectrum/standards

Private sector takes the lead as the V2X market matures

USDOT facilitates V2X community building and develops benefit-cost pipeline

- USDOT Action
- IOO Action
- Private Sector Action

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Short Term Goals & Targets (2024–2026)

Leading Deployers in Operation

2023 · 2026 · 2029 · 2034 — 12 → 25 → 50

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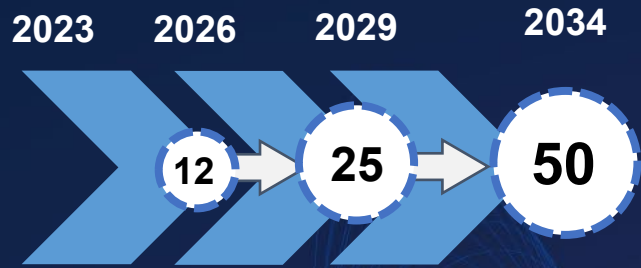| Strategic Focus Area	Goals	Milestones / Targets	Lead Stakeholders
Infrastructure Deployments	▪ 20% of the National Highway System has V2X technology deployed for freeway-based applications ▪ Top 75 Metro areas have 25% of their signalized intersections V2X-enabled	▪ 12 corridor/regional deployments* with demonstrated interoperability and tested cybersecurity ▪ 20 grants awarded across at least 10 states that include the use of the 5.9 GHz band	IOOs and their partners, primed by USDOT seed funding/grants
Vehicles	▪ 5.9 GHz equipped vehicles from leading OEMs are either in production or with formalized commitment	▪ 2 OEMs have 5.9 GHz capable vehicles in production (or commit to do so by 2027 model year) ▪ 10 public fleet operators outfit vehicles with aftermarket safety devices	Private sector (OEMs, aftermarket safety device vendors in coordination with public sector fleet operators
Spectrum	▪ 5.9 GHz spectrum finalized by the FCC with all rules/provisions in place, affirming a long-term spectrum commitment	▪ 5.9 GHz band final rules (FCC 2nd R&O) formally completed ▪ 2 V2X use cases demonstrated utilizing the 5.9 GHz band ▪ 2 V2X use cases demonstrated utilizing spectrum beyond the 5.9 GHz band	USDOT champions for V2X community
Interoperability	▪ All standards required for interoperability in 5.9 GHz band published ▪ Initial standards and architecture extending interoperability beyond 5.9 GHz band established	▪ 3 device suppliers and 2 OEMs demonstrate interoperability among products in an operational deployment ▪ 2 SCMS providers demonstrate interoperable security credentials management ▪ 5 certified devices on the market	Private sector, with USDOT and IOO support
Benefits and Technical Assistance	▪ Technical assistance programs help deployers to design, build, operate and maintain interoperable, cybersecure V2X ▪ Foundational educational materials, V2X benefit/cost case studies widely available	▪ 3 case studies documented on operational benefits and costs ▪ 25 active members in Accelerating V2X Cohort spanning 10 states ▪ 10 regional interoperable connectivity hands-on training events	USDOT acts as clearinghouse, sponsors community-building activity
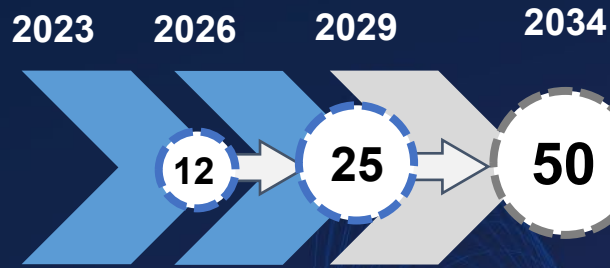
Medium Term Goals & Targets (2027–2029)

V2X Deployer Community Growth

2023   2026   2029   2034

12 → 25 → 50

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Strategic Focus Area	Goals	Milestones / Targets	Lead Stakeholders
Infrastructure Deployments	■ 50% of the National Highway System has V2X technologies deployed for freeway-based applications ■ Top 75 Metro areas have 50% of their signalized intersections V2X-enabled	■ 25 corridor/regional deployments* deployments with demonstrated interoperability and tested cybersecurity ■ 40% of the nation's intersections have V2X technology installed across large, mid-size and rural communities	IOOs and their partners, leveraging Bipartisan Infrastructure Law (BIL) resources
Vehicles	■ Work with NHTSA to explore data-driven strategies that could effectively incentivize interoperable systems and accelerated deployment ■ OEM production vehicles utilize IOO data ■ Interoperable connectivity data exchanges support early vehicle automation use cases	■ 5 vehicle models are 5.9 GHz capable, including 2+ heavy/ commercial vehicle models ■ 3 active deployments generate IOO data used by 2 OEM production vehicles ■ 4 suppliers, 3 OEMs demonstrate interoperable connectivity	Private sector, USDOT leads internal NHTSA coordination
Spectrum	■ Use cases beyond 5.9 GHz spectrum are well-defined and shared widely	■ 5 V2X use cases demonstrated utilizing the 5.9 GHz band ■ 5 V2X use cases demonstrated utilizing spectrum beyond the 5.9 GHz band	Private sector, with USDOT and IOO support
Interoperability	■ Reference implementation for interoperable connectivity developed and delivered ■ Reliable, scalable device certification processes utilized by multiple vendors.	■ 20 public agencies demonstrate interoperable connectivity ■ SCMS credentials are in active interoperable use from 2 providers ■ 10 certified devices on the market	Private sector, with USDOT and IOO support
Benefits and Technical Assistance	■ Report published documenting the cost-benefits of investing in V2X tech ■ ITS community delivers a plan update on its progress towards national deployment	■ 6 use cases (2 involving vulnerable road users) document V2X safety benefits ■ 50 active members of USDOT Accelerating V2X Cohort author progress report, spanning 25 states	USDOT acts as clearinghouse, facilitates community

Long Term Goals & Targets (2030–2034)

2023   2026   2029   2034

12 → 25 → 50

Nationwide Interoperable V2X Deployed

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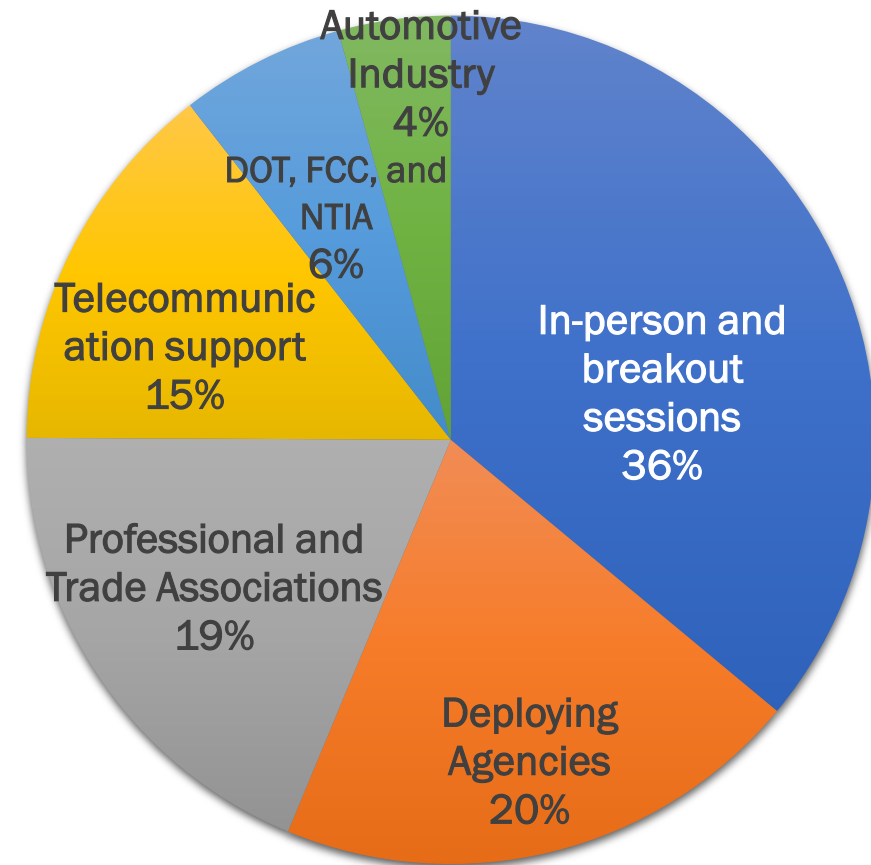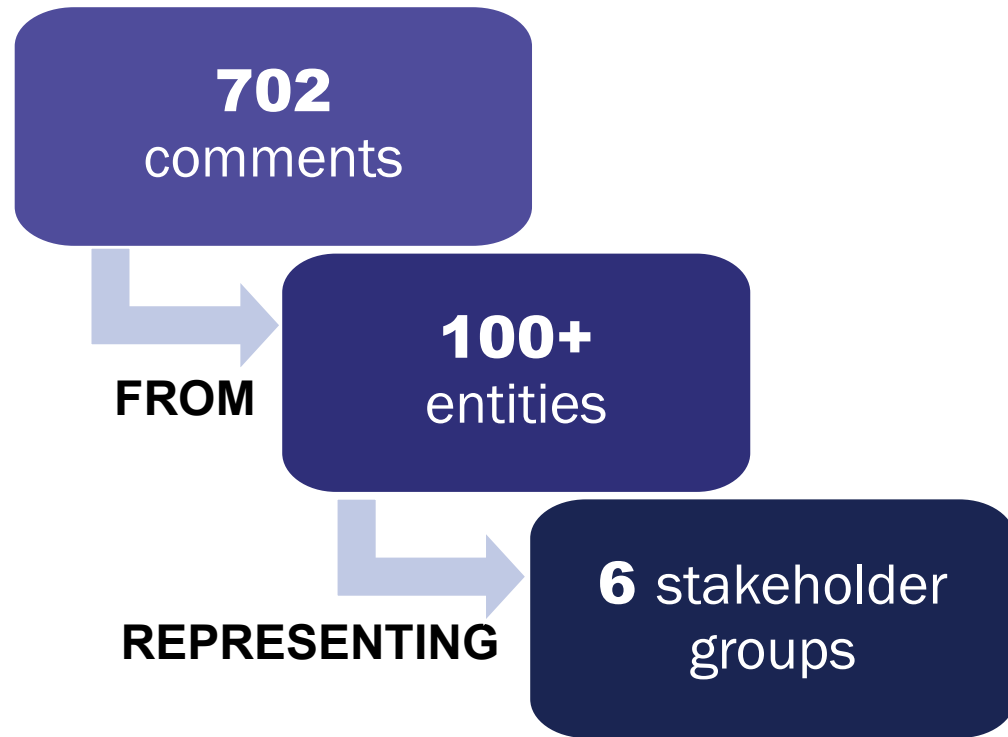| Strategic Focus Area	Goals	Milestones / Targets	Lead Stakeholders
Infrastructure Deployments	■ V2X interoperable connectivity deployed widely, seen as a fundamental element of system operations, and functions within a mature ecosystem featuring all stakeholders ■ The National Highway System is fully deployed for freeway-based applications ■ Top 75 Metro areas have 85% of their signalized intersections V2X-enabled	■ 50 corridor/regional deployments* with demonstrated interoperability and tested cybersecurity ■ Interoperable 5.9 GHz operations demonstrated across 50 states ■ 75% of the nation's intersections have V2X technology installed across large, mid-size and rural communities	IOOs and their partners, leveraging program funding
Vehicles	■ Adoption of interoperable connectivity by infrastructure owners/operators and OEMs is widespread, including vehicle automation cases where applicable	■ 6 OEMs have 5.9 GHz capable production vehicles employing safety-related use cases ■ 20 vehicle models are 5.9 GHz capable, including 12+ heavy/commercial vehicle models	Private Sector (OEMs) and their partners
Spectrum and Interoperability	■ Interoperability realized for use cases both within and beyond the 5.9 GHz spectrum, including vehicle automation where applicable ■ Reference implementation for interoperable connectivity enhanced and maintained ■ Certified devices dominate dynamic V2X technology base	■ 5 V2X use cases operational in the 5.9 GHz band in all 50 states ■ 5 V2X use cases operational in spectrum beyond the 5.9 GHz band in 5+ states ■ 20 certified devices dominate deployed V2X technology base	Industry acts as champion for the V2X community
Benefits and Technical Assistance	■ National benefits and costs pipeline established drawing from on data streaming from operational systems	■ 10 deployments in operations for 5+ years streaming benefits and cost data ■ 75 active members of USDOT Accelerating V2X Cohort sponsor ongoing pooled fund projects spanning 45 states	USDOT acts as clearinghouse, partners with pooled fund partners

Feedback Received

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Stakeholder Feedback Received on the Plan

702 comments

FROM

100+ entities

REPRESENTING

6 stakeholder groups

Automotive Industry 4%

DOT, FCC, and NTIA 6%

Telecommunication support 15%

In-person and breakout sessions 36%

Professional and Trade Associations 19%

Deploying Agencies 20%

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Identified Feedback Themes - Policy

ID	Theme	# of Comments	% of Comments
1.	Offer long-term funding strategy.	66	9.4%
2.	Offer incentives and seek commitments from OEMs.	66	9.4%
3.	Foster coordination among federal agencies.	56	8.0%
4.	Need realistic targets and goals.	45	6.4%
5.	Develop a national credential authority service to ensure security/privacy.	35	5.0%
6.	Secure Commitment from FCC.	32	4.6%

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Identified Feedback Themes - Technical
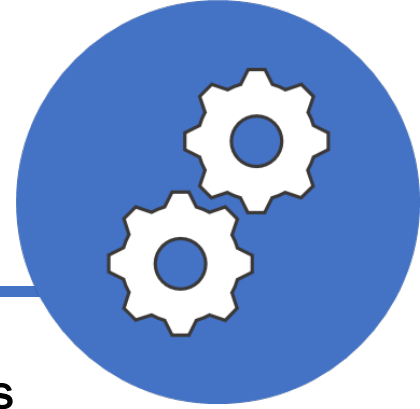
ID	Theme	# of Comments	% of Comments
1.	Develop technical assistance and resources for deployers of V2X.	103	14.7%
2.	Look beyond 5.9 GHz band for communications.	58	8.3%
3.	Address deployment issues.	57	8.1%
4.	Support IOOs and Mobile Network Operators.	34	4.8%
5.	Track progress on reaching targets.	29	4.1%
6.	Address data concerns.	26	3.7%
7.	Educate the public about the benefits of V2X.	25	3.6%
8.	Define interoperable connectivity.	23	3.3%
9.	Emphasize Vulnerable Road Users.	21	3.0%
10.	Identify Day 1 applications.	15	2.1%
11.	Engage stakeholders from insurance companies, law enforcement, and trucking industry.	11	1.6%

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Companion Documents and Context

	Executive Summary of National V2X Deployment Plan	National V2X Deployment Plan	Technical Appendix to National V2X Deployment Plan	V2X Deployer Resources
Audience	Stakeholders (USDOT, Public Agencies, & Private Sector)	Stakeholders (USDOT, Public Agencies, & Private Sector)	Agency technical staff with a range V2X experience	Project Manager or Project Engineer
Purpose	• Shorter, summarized version of the National V2X Deployment Plan • Vision, Mission, Goals, Measures, Targets • Stakeholder roles and responsibilities • Call to Action	• Vision, Mission, Goals, Measures, Targets • Stakeholder roles and responsibilities • Call to Action	• More detail on achieving interoperability and supporting elements of the Plan • More information on how progress against goals could be tracked and assessed	• How-to information for deployers • Important concepts and key resources for deployment • Builds from National V2X Deployment Plan and Technical Appendix

Less technical   Depth (increasing) +   **More technical**

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Next Steps

- Release the Final National V2X Deployment Plan
- Announce V2X NOFO ($40M FHWA Tier 2) awards
- Continue stakeholder engagements through the CAT-C, V2X Cohort, V2X Summits, etc.
- Publish companion technical resources
- Work with NTIA and FCC to release FCC's Second Report an order
- Continue to address Key Focus areas

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Grants to Accelerate V2X Deployment

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USDOT Grants to Accelerate V2X

Rough Estimates

$283,955,984

awarded in grants since ~2016
(ATCMTD/ATTAIN, SMART, SS4A,
CV Pilots, SCC, and Others)

44 projects

from 34 public agencies
(~$6.4M per project)

...in 19 states

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ATTAIN Grants

- The [Advanced Transportation Technology and Innovation](#) (ATTAIN) program, provides funding to deploy, install, and operate advanced transportation technologies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment.

- $120 million ($60 million for FY 2023 and $60 million for FY 2024)

- FY 2023 Close Date: February 2, 2024

- The federal cost-share is 80 percent; the applicant must supply the remaining 20 percent.

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ATTAIN Grants – Eligible Uses

Grant recipients may use funds under this program to deploy the following advanced transportation and congestion management technologies:

- Advanced traveler information systems;

- Advanced transportation management technologies;

- Advanced transportation technologies to improve emergency evacuation and responses by federal, state, and local authorities;

- Infrastructure maintenance, monitoring, and condition assessment;

- Advanced public transportation systems;

- Transportation system performance data collection, analysis, and dissemination systems;

- Advanced safety systems, including V2V and V2I communications, technologies associated with automated vehicles, and other collision avoidance technologies, including systems using cellular technology;

- Integration of intelligent transportation systems with the smart grid and other energy distribution and charging systems;

- Integrated corridor management systems;

- Advanced parking reservation or variable pricing systems or systems to assist trucks in locating available truck parking;

- Electronic pricing, toll collection, and payment systems;

- Technology that enhances high-occupancy-vehicle toll lanes, cordon pricing, or congestion pricing;

- Integration of transportation service payment systems;

- Advanced mobility access and on-demand transportation service technologies, such as dynamic ridesharing and information systems to support human services for elderly and disabled individuals;

- Retrofitting dedicated short-range communications (DSRC) technology deployed as part of an existing pilot program to cellular vehicle-to-everything (C-V2X) technology, or

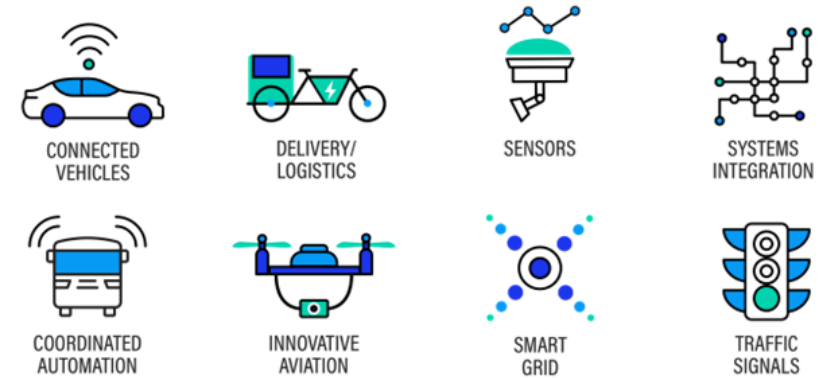- Advanced transportation technologies, in accordance with the research areas described in section 6503 of Title 491.

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SMART Grants

- The [Bipartisan Infrastructure Law](#) (BIL) established the Strengthening Mobility and Revolutionizing Transportation (SMART) discretionary grant program with $100 million appropriated annually for fiscal years (FY) 2022-2026.

- SMART is a **two-stage program**.
    - Stage 1 (up to $2,000,000 dollars and 18 months) grants are open for any eligible entity to apply.
    - Recipients of Stage 1 grants will be eligible to expand their projects through Stage 2 grants (up to $15,000,000 and 36 months).

- USDOT anticipates the FY24 Stage 1 NOFO will be released in spring 2024.

Technology Areas

CONNECTED VEHICLES

DELIVERY/ LOGISTICS

SENSORS

SYSTEMS INTEGRATION

COORDINATED AUTOMATION

INNOVATIVE AVIATION

SMART GRID

TRAFFIC SIGNALS

www.transportation.gov/grants/SMART

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FY 2023 SMART Grants – Example V2X Projects

The 34 projects [announced](#) on March 14, 2024, span 22 states, the District of Columbia, and Puerto Rico.

Recipient	Project Name	Funding	Project Summary
City of Anaheim, CA	Improving Safety & Efficiency through Connected Intersections Technologies in Anaheim	$2,000,000	Use off-the-shelf V2X technologies and automated traffic signal performance measures to test the effectiveness of signal priority and red-light violation warning use cases at signalized intersections on two corridors.
Henry County Government, GA	Henry County Connected Vehicle Pilot and Plan Development	$825,000	Test CV2X technologies for emergency vehicle preemption at intersections.
East Central Intergovernmental Association, IA	Metro Dubuque Traffic Data Aggregation for Connected Vehicles project	$2,000,000	Develop an open CV2X interface to disseminate near-real time transportation information across a 3-state area.
Pennsylvania Department of Transportation, PA	V2X Data Exchange Vehicle Integration	$1,784,556	Pilot a V2X system for curve speed warnings via cellular network to drivers.
City of Chattanooga, TN	Advancing Interoperable Connectivity for Improving Safety and Operations in the City of Chattanooga	$2,000,000	Implement a CV2X solution for detecting vulnerable road users at midblock crossings.

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Safe Streets and Roads for All (SS4A)

- **$5 billion** discretionary grant program, with ~$1 billion/year over 5 years.

- Prevent deaths and serious injuries on our roadways.

- Focus on comprehensive safety action planning and implementing those plans.

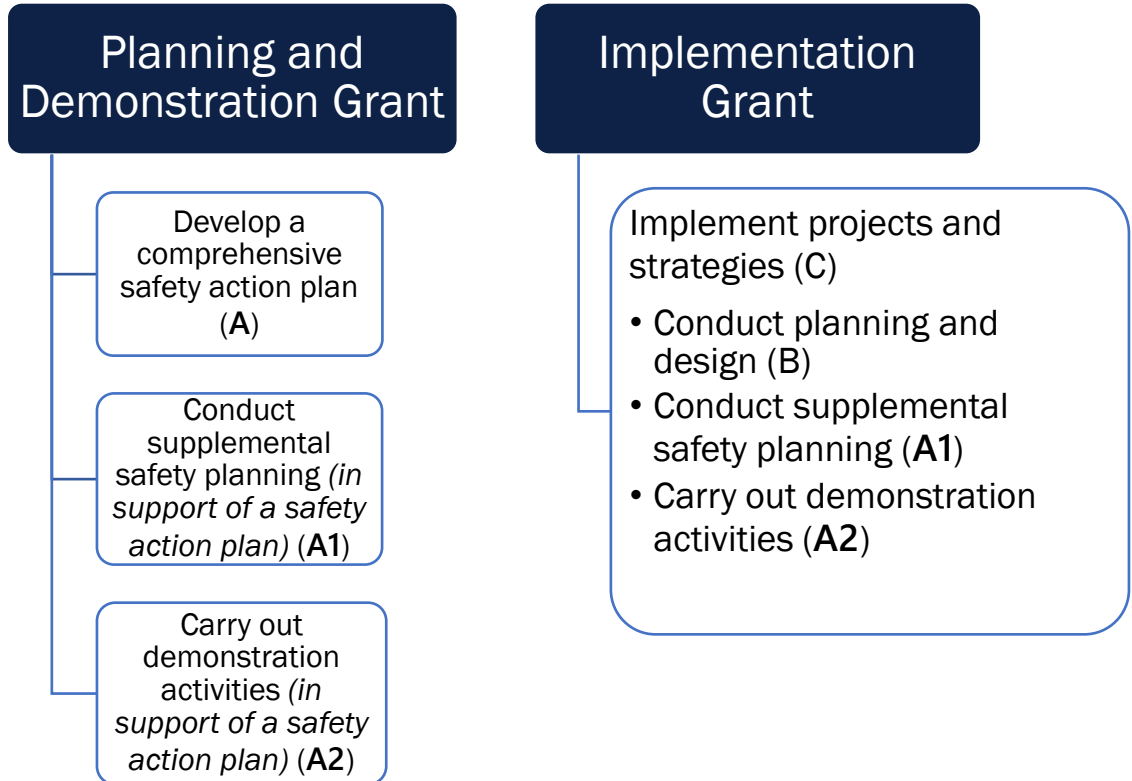- Inclusive of all types of roadway safety interventions across the Safe System Approach (SSA).

http://www.transportation.gov/SS4A

SS4A - Eligible Activities and Grant Types

Eligible Activities:

- Develop Comprehensive Safety Action Plan
  - (A1) Supplemental safety planning
  - (A2) Demonstration activities

- (B) Conduct planning, design, and development activities for projects and strategies identified in an Action Plan

- (C) Implement projects and strategies identified in an Action Plan

Planning and Demonstration Grant

Develop a comprehensive safety action plan (**A**)

Conduct supplemental safety planning *(in support of a safety action plan)* (**A1**)

Carry out demonstration activities *(in support of a safety action plan)* (**A2**)

Implementation Grant

Implement projects and strategies (**C**)

- Conduct planning and design (**B**)
- Conduct supplemental safety planning (**A1**)
- Carry out demonstration activities (**A2**)

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SS4A - Planning and Demonstration Activities

Action Plan

- Develop, update, or complete a Comprehensive Safety Action Plan

- 8 components to an Action Plan

Supplemental Planning

- Topical safety plans

- Road safety audits

- Additional safety analysis and data collection

- Targeted equity assessments

- Follow-up stakeholder engagement

Demonstration Activities

- Feasibility studies using quick-build strategies

- Pilot programs for behavioral or operational activities

- Pilot programs for new technology

- Manual on Uniform Traffic Control Device (MUTCD) engineering studies

Source: Solomon Foundation

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SS4A – Implementation Grants

- Implementation Grants applications must fund projects and strategies identified in an Action Plan that address a roadway safety problem.

- Infrastructure, behavioral, and operational safety activities are all eligible.

- Applicants must have a qualifying Action Plan in place to apply for Implementation Grants.

- Implementation applications may also include supplemental planning and demonstration activities.

Source: FHWA

Example Demonstration Activities – New Technology Pilots

- **Pilot programs that demonstrate safety benefits of new technologies.** Eligible technologies must be commercially available, not yet adopted in the community, and at a prototype or advanced technological readiness level.

- Examples include:
  - Variable speed limits
  - Speed safety cameras installations
  - Retrofitting public transit with dash cameras
  - Adaptive signal timing
  - Signal preemption for emergency vehicles
  - Safety warnings for wrong-way driving alerts
  - Intelligent Transportation Systems
  - **V2X technology, especially those that use the 5.905 – 5.925 GHz spectrum frequency**

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FY24 SS4A Application Deadlines

- There are three separate application deadlines for Planning and Demonstration Grant applications in FY24:

  1. April 4, 2024, 5 PM (ET)

  2. **May 16, 2024, 5 PM (ET)**

  3. **August 29, 2024, 5 PM (ET)**

- Planning and Demonstration Grant applicants may apply in **any of the three** application rounds.

- Planning and Demonstration Grant applicants may **reapply** if their application is not initially selected for funding.

- Implementation Grant applicants have a single deadline for the FY24 SS4A NOFO: **May 16, 2024, by 5 PM (ET).**

New in FY24

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FCC Update

Intelligent Transportation Systems
ITS / V2X Communications for Deployment

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Coordination with FCC and NTIA

- In January 2024, NTIA, FCC and DOT started conducting monthly coordination meetings to discuss topics important to V2X and the 2nd Report and Order

- Main topics of discussion include:
  - Out-of-Band Emissions (OOBE) Limits
  - Geofencing concept to support higher LTE-V2X power transmissions
  - Schedule for delivering the 2nd Report and Order

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OOBE Testing

- To maximize the protection of the remaining 5.9 GHz band, DOT has been conducting OOBE testing to advocate for stricter OOBE limits in the U-NII-4 and U-NII-5 bands
  - U-NII-4 is unlicensed spectrum right below the 5.9 GHz band (5.850-5.895 GHz)
  - U-NII-5 is unlicensed spectrum right above the 5.9 GHz band (5.925-6.425 GHz)

- In certain scenarios without adequate OOBE limits, these frequency bands can reduce the range of LTE-V2X communications
  - The specific scenario of most concern is a mobile Wi-Fi hotspot operating in the vehicle

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Example of NLOS OOBE Interference

-27 dBm Mask

-37 dBm Mask

No Interference

PER vs Distance (Approaching)

PER vs Distance (Separating)
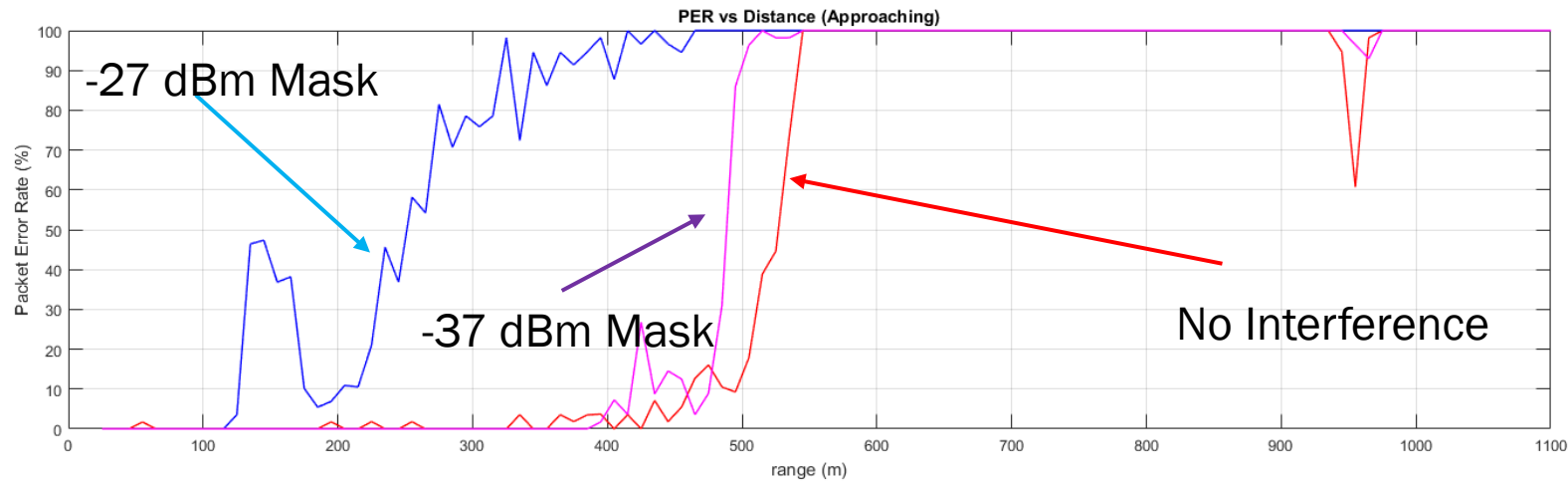
SUMMARY RESULTS

V2X Communications Range where PER <10%
-27 dBM: 135 meters
-37 dBm: 445 meters
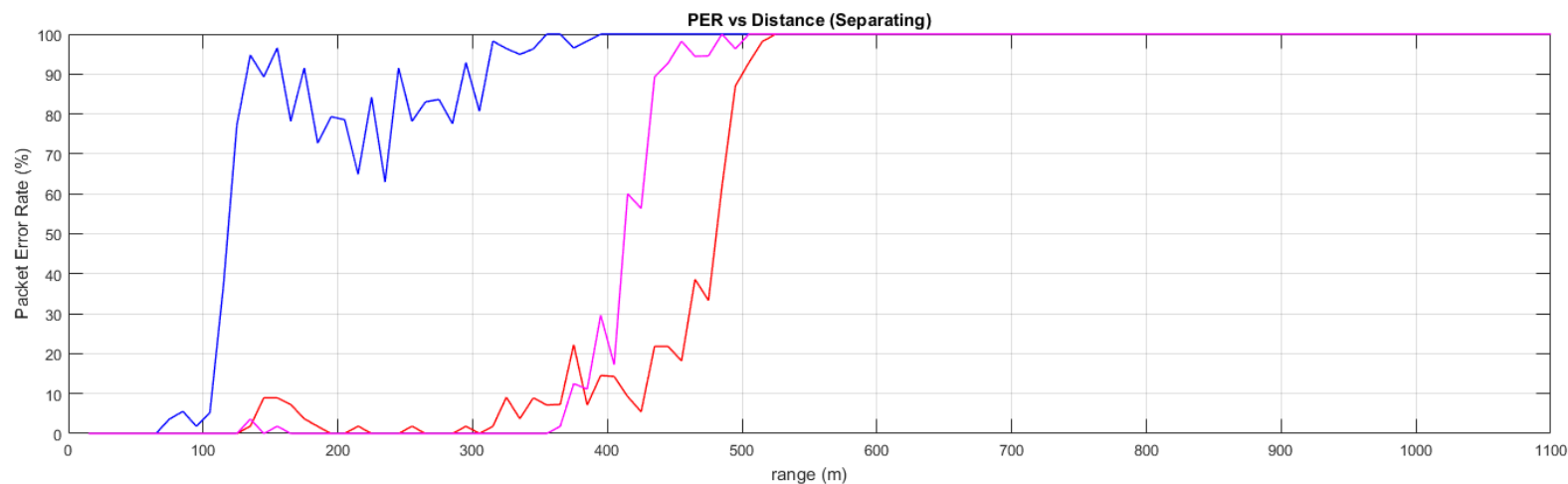
SUMMARY RESULTS

V2X Communications Range where PER <10%
-27 dBM: 125 meters
-37 dBm: 375 meters

34

OOBE Testing on the FCC Docket

- DOT is developing a detailed test report on the OOBE testing and it will be published on the ITS JPO webpage

- DOT is also developing multiple technical memorandums that address this testing and the impact of harmful OOBE on critical safety applications
  - These tech memos will be posted to the FCC docket

- The ITS industry has done an outstanding job posting their own filings to the FCC docket that cite our past work

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LTE-V2X Geofencing

- Industry and proposed a geofencing capability that would allow LTE-V2X devices to broadcast at up to 33 dBm
  - LTE-V2X radios would have kml files that create geofences around the military radar sites where LTE-V2X communications cause issues
  - When a device enters one of these geofences, the device would automatically lower its' broadcast power

- NTIA restarted the 5.9 GHz Technical Interchange Group (TIG) to discuss this topic and it could potentially appear in the 2nd R&O
  - The 5.9 GHz TIG is currently reviewing a geofencing test plan with a potential test of the concept in the summer

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FCC 2ⁿᵈ R&O Listening Sessions

- FCC and the DOT are interested in capturing the ITS Stakeholder community's opinions on certain 2ⁿᵈ R&O topics

- DOT is conducting listening sessions to capture these opinions
  - First session was conducted at the ITS America Conference
  - Next session will be conducted at OmniAir Plugfest (May 16ᵗʰ)
  - DOT is working on conducting a virtual listening session in late May/early June

- These listening sessions are open to all, however if you can't make one of these sessions but would like to provide feedback, please reach out to justin.anderson@dot.gov

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V2X Training & Other Resources
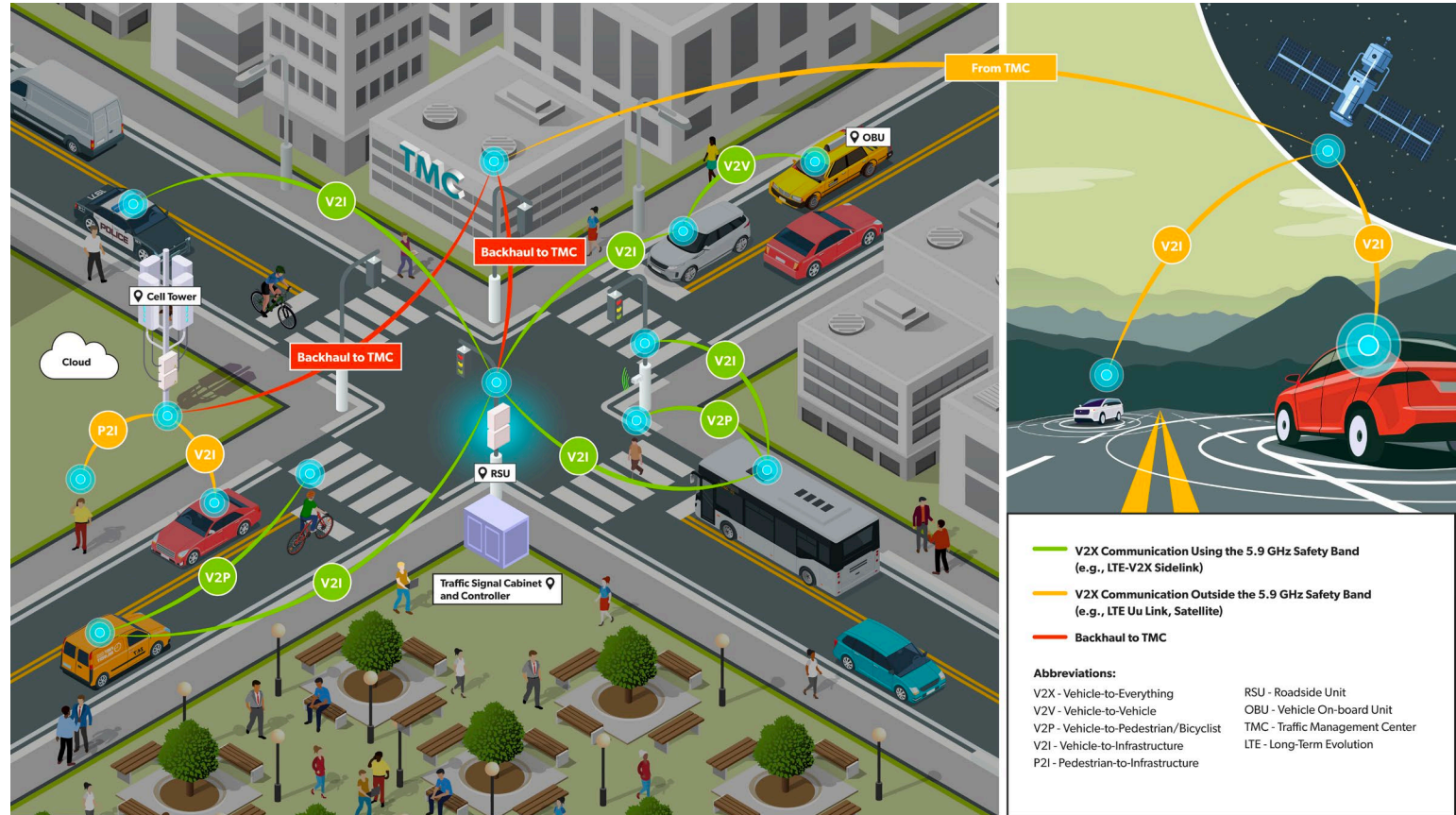
Foundational V2X Training

Training Overview

- Equips participants with a basic understanding of V2X concepts:
    - Introduces key components that enable a vehicle-to-everything (V2X) ecosystem
    - Discusses potential benefits of the technology
    - Provides an overview of example use cases and the messages and standards that support them while ensuring safety and privacy
- Intended for participants that are new to V2X, as well as individuals interested in refreshing their knowledge of key V2X concepts.

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Foundational V2X Training

FOUNDATIONAL COURSE

Module 1: The Case for Interoperable Connectivity (V2X)	Module 2: Vehicle-to-Everything (V2X) Basics	Module 3: USDOT V2X Resources and Technical Assistance

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Foundational V2X Training

Module 1 Overview

- Transportation Challenges – Safety Mobility and Environmental Challenges
- Addressing the Challenges
  - Existing ITS Solutions and In-Vehicle Systems
- Introduction to Vehicle-to-Everything (V2X)
  - Addressing Challenges with Vehicle-to-Everything (V2X)
- Interoperable Connectivity – What is interoperability and why is it important?
- Accelerating Deployment
  - National V2X Deployment Plan
  - Planned and Existing V2X Deployments
  - Example Real World Deployments

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Foundational V2X Training

Module 2 Overview

- V2X Ecosystem and Architecture
- V2X Communications Technologies
- V2X Elements
  - V2X and ITS Roadside Infrastructure
  - In-Vehicle Systems
  - TMC/Back Office Systems
  - V2X External Support Systems
- V2X Messages
- V2X Use Cases (Applications)

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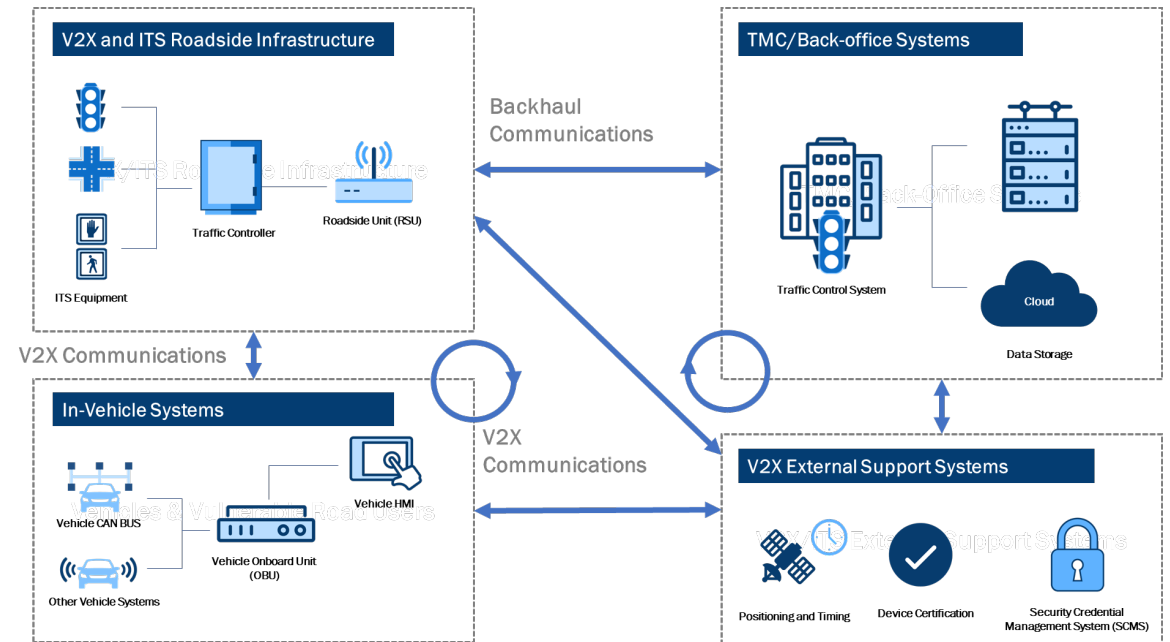
Foundational V2X Training

Module 3 Overview

- National V2X Deployment Plan & Deployer Resource Document
- Smart Community Resource Center (SCRC): V2X Page
- ARC-IT
- ITS Deployment Evaluation – Benefits and Costs
- Accelerating V2X Cohort
- V2X Tools
- Equipment Loan and Help Desk
- Future V2X Trainings

V2X Training at the ITSA Annual Meeting

- A *Pilot Training*

- Delivered Thursday April 25, 2024: 1:00 to 5:00 pm in Phoenix, AZ

- Over 60 participants
  - 25% not familiar with V2X
  - 56% somewhat familiar
  - 19% very familiar

- The training will be enhanced based on feedback from participants

Pie chart:
- Consultant 26%
- USDOT 10%
- State or Local DOT 12%
- Vendor 32%
- Association 4%
- Academic 8%
- Other 8%

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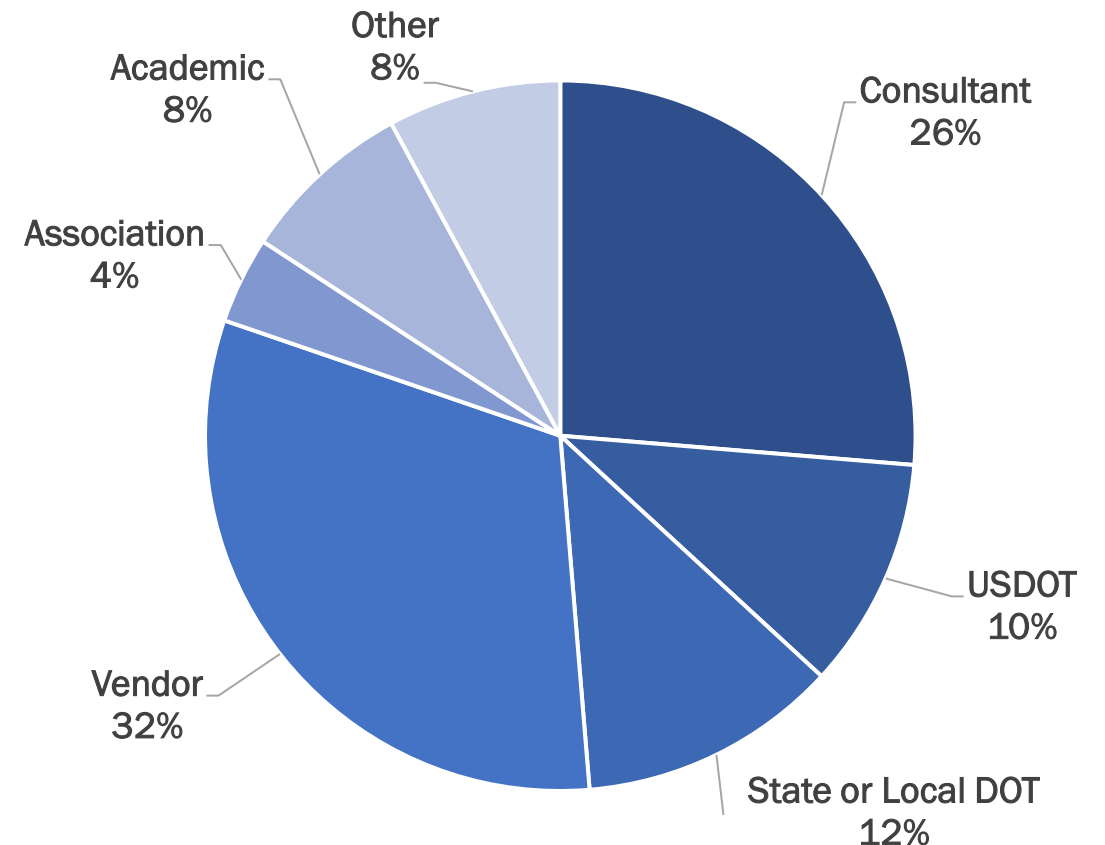
What Are You Most Interested in Learning About?

Basic CV Information

SCMS

The overall of what V2X is and what it encompasses

V2X in transportation planning implementation

Infrastructure above the radio

New to V2X

How to get started in learning about C-V2X

Just to reinforce my skillset

Overview

V2X Basics

High level overview to get a fuller picture of V2X

V2X direct communications and SCMS

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What Are You Most Interested in Learning About?

How to make scalable ITS solutions using various connectivity technologies

Staying up to date with the latest on V2X

V2X Cybersecurity

Required HW and SW infrastructure to enable V2X now

General info

V2X terminology

Latest terminology and future national direction and standards

The basics of V2X and why it is needed, what it does, etc.

Real worlds V2X applications, deployed and future ideas

V2X, get deeper on technical details. Why are OEMs slow to implement?

Use Cases and Interoperability

Making sure my understanding of V2X is consistent with reality

	Average Score
Course Effectiveness	
1. The course covered the specific objectives	**4.5** out of **5**
2. The course content met my expectations	**4.3** out of **5**
3. The course was well organized	**4.3** out of **5**
4. Training time was well used	**4.3** out of **5**
5. Instructional activities and materials used during the program were appropriate	**4.3** out of **5**
6. There was sufficient time and opportunity for questions and discussion	**4.4** out of **5**
7. I received skills and knowledge that can be used in my job	**4.5** out of **5**
8. The training was a valuable use of my time	**4.4** out of **5**
Instructor Effectiveness	
1. The instructor(s) had a thorough knowledge of the subject matter	**4.8** out of **5**
2. The instructor(s) communicated the subject matter well	**4.6** out of **5**
3. The instructor(s) used relevant examples	**4.7** out of **5**
4. The instructor(s) facilitated discussion well and interaction with participants was effective	**4.6** out of **5**

Comments on Opportunities for Enhancements

- Module 1 (the Case for V2X) was too long and can be scaled back; more time in Module 2

- Discuss tools for convincing agencies of the value of deploying V2X now

- More discussion on the National V2X Deployment Plan

- Maybe actually having some equipment?

- More examples of real-world deployments

- Moved quickly on the Architecture slides

- Providing a summary on the current state of the technology

- Next Course: Deeper dive into the standards and challenges implementing

- Include a glossary and definitions

- More in-depth discussion on communications

- How to find references and standards

- Include an interactive exercise to develop a V2X Concept

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Foundational V2X Training

- Several ITS State Chapters that have expressed interest:
  - ITS Georgia
  - ITS Maryland
  - ITS Minnesota
  - ITS Tennessee
  - ITS Texas
  - New Jersey DOT
  - Gulf Region Intelligent Transportation Society (GRITS)
  - Others…

Future V2X Training Areas?

Foundational Track

- The Case for Interoperable Connectivity (V2X)
- V2X Basics
- USDOT V2X Technical Assistance Resources

Planning and Systems Engineering Track

- Incorporating V2X into the Transportation Planning Process
- The Business Case for V2X
- Concept Development and Foundational Planning
- Performance Measurement and Evaluation

Detailed Technical Track

- Leveraging ARC-IT and Standards for V2X
- Deploying V2X Infrastructure
- MAP and SPaT Preparation
- SCMS and Security
- Wireless Communication
- Managing V2X Data
- V2X Operations & Maintenance

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Other Technical Assistance Resources

- ## V2X Glossary
  - Define key V2X Terms
    - Cite trusted resources (e.g., V2X Standards), as appropriate
  - Clarify terms that are being introduced that may be causing confusion

- ## V2X Standards Taxonomy
  - Provide a taxonomy that shows all existing and planned V2X activities
  - Provide a short description of each standard with a link to the standard
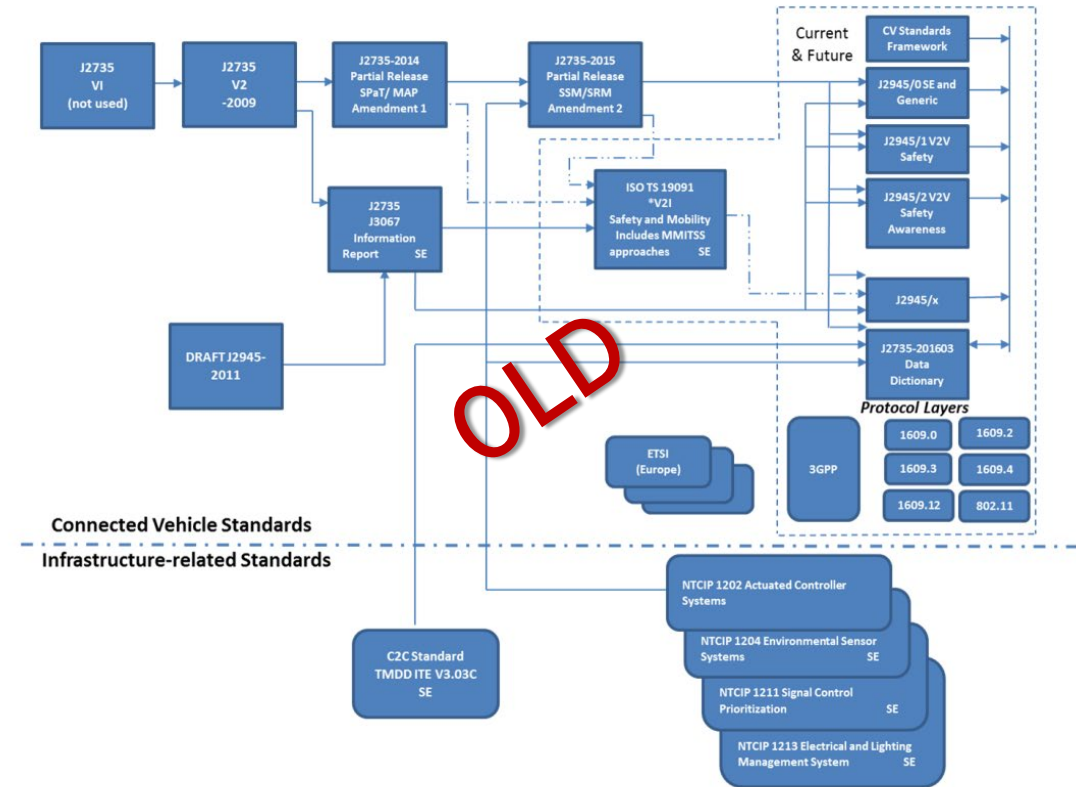
Figure 1: Framework of Connected Vehicle Standards

Source: USDOT

Smart Community Resource Center

Questions?

J.D. Schneeberger

ITS Joint Program Office (JPO)

Program Manager, ITS Professional
Capacity Building Program
Email: John.Schneeberger@dot.gov

Justin Anderson

ITS Joint Program Office (JPO)

Program Manager, Next Generation
Wireless Communications & SCMS
Email: Justin.Anderson@dot.gov

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