



**DRAFT**

# Saving Lives with Connectivity:

**A Plan to Accelerate V2X Deployment**



U.S. Department of Transportation

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## Introduction

The U.S. Department of Transportation (USDOT) is committed to reducing deaths and serious injuries on our nation’s roadways. As it implements the National Roadway Safety Strategy, the USDOT is actively pursuing a comprehensive approach to reduce the number of roadway fatalities to the only acceptable number: zero.

**The only acceptable number of roadway deaths is zero.**

A powerful tool for achieving this ambitious, long-term goal is vehicle-to-everything (V2X) technology, which enables vehicles to communicate with each other, with other road users such as pedestrians and cyclists, and with roadside infrastructure. Deployments utilizing V2X technologies have demonstrated the safety benefits on a smaller scale. However, to realize the full lifesaving potential of V2X technology will require vehicles and infrastructure to communicate safely, securely, and without harmful interference across a variety of devices and platforms.

**V2X can save lives by enabling wireless communications among vehicles, roadside infrastructure, and mobile devices.**

Integrating technology and connectivity into a Vision Zero approach requires that technology operates with many other devices, users, vehicles, and infrastructure. We call this ‘interoperable connectivity,’ where a diverse range of mobile, in-vehicle, and roadside technologies must be able to communicate everywhere, efficiently, and securely, and to protect personal information. Connected V2X technology must be reliable and seamless to allow communities and users to effectively move across boundaries, meeting their needs and destinations every day.

V2X communication supports the Safe System approach adopted by the *National Roadway Safety Strategy*. The Safe System approach is a holistic and comprehensive approach that provides a guiding framework to make places safer for people. It works by building and reinforcing multiple layers of protection to both prevent crashes from happening in the first place and minimize the harm caused to those involved when crashes do occur (Figure 1).

The *National Roadway Safety Strategy* directs the USDOT to advance the use and deployment of V2X and other technologies to advance safer roadways. The [National Transportation Safety Board](#) has likewise identified V2X connectivity as a safety-critical “most wanted” technology.



**Figure 1. Principles of a Safe System Approach**

Source: USDOT

Technology advancements in vehicles and infrastructure have enabled incremental improvements in roadway safety over the last decade, but roadway fatalities and injuries have taken a turn in the wrong direction. For example, [NHTSA estimates](#) 42,795 motor vehicle fatalities occurred in 2022, up 18 percent from 36,355 fatalities in 2019. A broader, transformational approach, defined by the Safe Systems approach in the NRSS, includes leveraging advanced technologies that can prevent or mitigate crashes. Bold leadership is needed to ensure connected V2X technologies are integrated into the surface transportation system. Not only does V2X technology save lives, but it also enhances mobility, bolsters efficiency, and reduces negative environmental impacts. Accelerating V2X deployment now is a crucial step to save lives.

## Plan Overview

This document presents a Draft Plan to accelerate the deployment of V2X. The Draft Plan sets the USDOT's vision, goals, and milestones, and issues a call to action for stakeholders, including the USDOT, public agencies, and the private sector.

The Draft National V2X Deployment Plan describes how deployments can start now and defines the specific actions needed across stakeholder groups. It also identifies support available from the USDOT and other sources. This Draft Plan provides stakeholders with vital information to accelerate investment, research, and deployment in V2X technologies and helps stakeholders plan near-term and mid-term priorities while providing market certainty. This Draft Plan helps build technical and institutional capacity for future deployment needs. The Draft Plan seeks to reduce uncertainty among all stakeholders working towards the vision of a nationwide, interoperable V2X ecosystem.

**V2X connectivity is a crucial, lifesaving tool in the safety toolbox ready to deploy now.**

The Draft Plan will be supported by a supplemental technical document, *V2X Deployer Resources*, to be released in early 2024. The *V2X Deployer Resources* document discusses in detail information state and local agencies will find helpful to plan and deploy V2X projects. The USDOT will also provide ongoing technical assistance through peer-to-peer exchanges (e.g., the Accelerating V2X Cohort) and online resources such as the Smart Community Resource Center.

## Notable USDOT Actions for Accelerating V2X Deployment

The Draft National V2X Deployment Plan builds from legacy and current USDOT activities. Notable USDOT actions initiated since August 2022 are shown in [Table 1](#).

**Table 1. Notable USDOT Actions Initiated Since August 2022**

### Demonstrating Federal Leadership

- In August 2022, the USDOT held an inaugural summit to identify a path forward for V2X deployment. At the summit, stakeholders identified key issues and challenges impacting V2X deployment. Feedback from the summit underscored a desire within the intelligent transportation systems (ITS) community for strong federal leadership toward interoperable connectivity. The USDOT convened a second summit in April 2023 to report on progress and gather input for the development of a National V2X Deployment Plan.
- In response to stakeholder feedback and the need for strong federal coordination, the USDOT drafted this National V2X Deployment Plan to show its commitment to using V2X to save lives and accelerate technology innovation and deployment to advance Departmental goals

### Resolving Regulatory Uncertainty

- Worked with the National Telecommunications and Information Administration (NTIA) and Federal Communications Commission (FCC) to expedite the granting of waivers to permit the immediate deployment of V2X technology. The FCC granted 14 waiver requests in April 2023 and a second group of Waiver Orders to 17 organizations, including state departments of transportation, in August 2023. Each of these 17 organizations agreed to comply with the conditions set forth in the Joint Parties Waiver Order issued in April 2023. As of September 30, 2023, a total of 31 waiver requests had been granted. There are 13 organizations with pending waiver requests, including seven from the private sector and six from the public sector.
- Continues to conduct spectrum testing to provide data to the FCC and NTIA to ensure the release of the FCC's Second Report and Order on cellular V2X (C-V2X) technology.

### Providing Technical Assistance and Resources to V2X Deployers

- Provides professional capacity building through the [Connected Vehicle Deployer Resources](#). Resources include the [Connected and Automated Vehicle Education \(CAVE\)-in-a-box](#) kit.
- Operates the Technical Assistance and Equipment Loan program, which gives deployers the opportunity to borrow V2X equipment for testing to ensure it will work with their existing infrastructure. Deployers can email [CAVSupportServices@dot.gov](mailto:CAVSupportServices@dot.gov).
- Provides technical assistance to agencies for [requesting waivers](#). In July 2023, the USDOT provided support to multiple agencies regarding filing a request for an FCC waiver.
- Created a page on interoperable connectivity on the [Smart Community Resource Center](#) website that provides resources for V2X planners and deployers.
- Developing a [fact sheet](#) documenting federal funding opportunities available for V2X planning and deployment under the Bipartisan Infrastructure Law.
- Initiated the development of a V2X Deployer Resources document that delves into the details that state and local agencies may find helpful to plan and develop V2X connectivity projects for their needs, which is expected to be released in early 2024.

### Convening Stakeholders and Sharing Best Practices

- Established a V2X peer group of 27 states and local agencies to share lessons learned and insights.
- Participates in national coalitions including AASHTO, ITS America, ITE, and 5GAA
- Hosted summits, workshops and online webinars in the development of this Draft Plan

### Identifying Tested Day-One V2X Applications

- Gathering information on proven V2X applications for inclusion in the V2X Deployer Resources document.

### Investing Federal Funds in V2X

- Invested \$61.5 million in V2X technology research and deployment through the FHWA Turner Fairbank Highway Research Program over the last five years, with \$12.5 million in follow-on research projects budgeted for FY24.
- Awarded seven SMART and four ATTAIN grants that include V2X elements
- Included V2X deployment in the Safe Streets and Roads for All (SS4A) Grant program (FY23).
- Initiated the Intersection Safety Challenge in April 2023.

# The Draft National V2X Deployment Plan

## Vision

Enable a safe, efficient, equitable, and sustainable transportation system through the national, widespread deployment of interoperable V2X technologies.

## Mission

Deploy interoperable V2X connectivity using the dedicated 5.9 GHz spectrum and other available spectrum through collaboration and coordination across federal government, the public sector, and private industry.

## Goals and Targets

The USDOT has established a set of short-term, medium-term, and long-term deployment goals and targets to focus activity and coordinate stakeholder actions for making progress toward achieving the vision. These goals and targets were informed by stakeholder inputs and engagements, USDOT research and development activities, as well as industry trends and developments.

The USDOT has defined three timeframes:

- Short-Term (2024 - 2026): Leading Deployers in Operation.
- Medium-Term (2027 - 2029): V2X Deployer Community Growth.
- Long-Term (2030 - 2034): Nationwide Interoperable V2X Deployed and Operational.

[Figure 2](#) summarizes key elements of the Draft National V2X Deployment Plan Roadmap.

Tables 2, 3, and 4 present the short-term, medium-term, and long-term goals, and corresponding targets, and responsible lead stakeholder group by strategic areas of Infrastructure Deployments, Vehicles, Spectrum, Interoperability, and Benefits/Technical Assistance.

Establishing goals for various timeframes will assist stakeholders in focusing on actions that can be taken now with the current state of knowledge and technology. Long-term outcomes can be influenced by external factors and continued technological and institutional developments. Due to inherent uncertainties, there is a need to regularly monitor and adjust these goals and targets.

## VISION

Enable a safe, efficient, equitable, and sustainable transportation system through the national, widespread deployment of interoperable V2X technologies.

## MISSION

Deploy interoperable V2X connectivity using the dedicated 5.9 GHz spectrum and other available spectrum through collaboration and coordination across federal government, the public sector, and private industry.

### Short Term (2024–2026)

#### Infrastructure Deployments

- V2X deployed on 20% of National Highway System
- Top 75 metro areas have 25% of signalized intersections V2X enabled
- 12 interoperable, cybersecure deployments
- 20 grants to 10 states for 5.9 GHz band use

#### Vehicles

- 2 Original Equipment Manufacturers (OEMs) commit to 5.9 GHz capable vehicles by 2027 model year

#### Spectrum and Interoperability

- 2 SCMS providers demonstrate interoperable security credentials management
- 3 device suppliers and 2+ OEMs demonstrate interoperability
- FCC completes 2nd Report and Order on 5.9 GHz band

#### Benefits and Technical Assistance

- 3 case studies on deployed V2X benefits/costs
- 25 active Accelerating V2X Cohort members
- 10 regional hands-on training events



Source: USDOT

### Medium Term (2027–2029)

#### Infrastructure Deployments

- V2X deployed on 50% of National Highway System
- Top 75 metro areas have 50% of signalized intersections V2X enabled
- 25 interoperable, cybersecure deployments
- V2X installed in 40% of the nation's intersections

#### Vehicles

- 5 vehicle models are 5.9 GHz capable
- 3 active deployments generate Infrastructure Owner-Operator (IOO) data used by 2 OEM production vehicles
- 4 suppliers, 3 OEMs demonstrate interoperable connectivity

#### Spectrum and Interoperability

- 5 V2X use cases demonstrated in the 5.9 GHz band
- 5 V2X use cases demonstrated beyond the 5.9 GHz band
- 20 public agencies demonstrate interoperability
- 2 providers utilize interoperable SCMS credentials
- 10 certified devices on the market

#### Benefits and Technical Assistance

- 6 use cases (2 involving vulnerable road users) document V2X safety benefits
- 50 active Accelerating V2X Cohort members author progress report

### Long Term (2030–2034)

#### Infrastructure Deployments

- V2X fully deployed on National Highway System
- Top 75 metro areas have 85% of signalized intersections V2X enabled
- 50 interoperable, cybersecure deployments
- Interoperable 5.9 GHz operations across 50 states
- V2X installed in 75% of the nation's intersections

#### Vehicles

- 6 OEMs have 5.9 GHz capable production vehicles for safety use cases
- 20 vehicle models are V2X capable

#### Spectrum and Interoperability

- 5 V2X use cases operational in the 5.9 GHz band in all 50 states
- 5 V2X use cases operational beyond the 5.9 GHz band in 5 states
- 20 certified devices dominate deployed V2X technology base

#### Benefits and Technical Assistance

- 10 deployments in operation for 5 years streaming benefits/cost data
- 75 active Accelerating V2X Cohort members sponsor pooled fund projects

Figure 2. Key Elements of the Draft National V2X Deployment Plan Roadmap

**Table 2. Draft National V2X Deployment Plan by Strategic Focus Area (Short-Term, 2024-2026)**

Strategic Focus Area	Goals	Milestones / Targets	Lead Stakeholders
<b>Infrastructure Deployments</b>	<ul style="list-style-type: none"> <li>■ 20% of the National Highway System has V2X technology deployed for freeway-based applications</li> <li>■ Top 75 Metro areas have 25% of their signalized intersections V2X-enabled</li> </ul>	<ul style="list-style-type: none"> <li>■ 12 corridor/regional deployments* with demonstrated interoperability and tested cybersecurity</li> <li>■ 20 grants awarded across at least 10 states that include the use of the 5.9 GHz band</li> </ul>	IOOs and their partners, primed by USDOT seed funding/grants
<b>Vehicles</b>	<ul style="list-style-type: none"> <li>■ 5.9 GHz equipped vehicles from leading OEMs are either in production or with formalized commitment</li> </ul>	<ul style="list-style-type: none"> <li>■ 2 OEMs have 5.9 GHz capable vehicles in production (or commit to do so by 2027 model year)</li> <li>■ 10 public fleet operators outfit vehicles with aftermarket safety devices</li> </ul>	Private sector (OEMs, aftermarket safety device vendors in coordination with public sector fleet operators)
<b>Spectrum</b>	<ul style="list-style-type: none"> <li>■ 5.9 GHz spectrum finalized by the FCC with all rules/provisions in place, affirming a long-term spectrum commitment</li> </ul>	<ul style="list-style-type: none"> <li>■ 5.9 GHz band final rules (FCC 2nd R&amp;O) formally completed</li> <li>■ 2 V2X use cases demonstrated utilizing the 5.9 GHz band</li> <li>■ 2 V2X use cases demonstrated utilizing spectrum beyond the 5.9 GHz band</li> </ul>	USDOT champions for V2X community
<b>Interoperability</b>	<ul style="list-style-type: none"> <li>■ All standards required for interoperability in 5.9 GHz band published</li> <li>■ Initial standards and architecture extending interoperability beyond 5.9 GHz band established</li> </ul>	<ul style="list-style-type: none"> <li>■ 3 device suppliers and 2 OEMs demonstrate interoperability among products in an operational deployment</li> <li>■ 2 SCMS providers demonstrate interoperable security credentials management</li> <li>■ 5 certified devices on the market</li> </ul>	Private sector, with USDOT and IOO support
<b>Benefits and Technical Assistance</b>	<ul style="list-style-type: none"> <li>■ Technical assistance programs help deployers to design, build, operate and maintain interoperable, cybersecure V2X</li> <li>■ Foundational educational materials, V2X benefit/cost case studies widely available</li> </ul>	<ul style="list-style-type: none"> <li>■ 3 case studies documented on operational benefits and costs</li> <li>■ 25 active members in Accelerating V2X Cohort spanning 10 states</li> <li>■ 10 regional interoperable connectivity hands-on training events</li> </ul>	USDOT acts as clearinghouse, sponsors community-building activity

\* Each regional/corridor deployment spans a minimum of 300 miles of roadway (combined highway and surface street) and/or 300 intersections/interchanges.

**Table 3. Draft National V2X Deployment Plan by Strategic Focus Area (Medium-Term, 2027-2029)**

Strategic Focus Area	Goals	Milestones / Targets	Lead Stakeholders
<b>Infrastructure Deployments</b>	<ul style="list-style-type: none"> <li>■ 50% of the National Highway System has V2X technologies deployed for freeway-based applications</li> <li>■ Top 75 Metro areas have 50% of their signalized intersections V2X-enabled</li> </ul>	<ul style="list-style-type: none"> <li>■ 25 corridor/regional deployments* deployments with demonstrated interoperability and tested cybersecurity</li> <li>■ 40% of the nation’s intersections have V2X technology installed across large, mid-size and rural communities</li> </ul>	IOOs and their partners, leveraging Bipartisan Infrastructure Law (BIL) resources
<b>Vehicles</b>	<ul style="list-style-type: none"> <li>■ Work with NHTSA to explore data-driven strategies that could effectively incentivize interoperable systems and accelerated deployment</li> <li>■ OEM production vehicles utilize IOO data</li> <li>■ Interoperable connectivity data exchanges support early vehicle automation use cases</li> </ul>	<ul style="list-style-type: none"> <li>■ 5 vehicle models are 5.9 GHz capable, including 2+ heavy/commercial vehicle models</li> <li>■ 3 active deployments generate IOO data used by 2 OEM production vehicles</li> <li>■ 4 suppliers, 3 OEMs demonstrate interoperable connectivity</li> </ul>	Private sector, USDOT leads internal NHTSA coordination
<b>Spectrum</b>	<ul style="list-style-type: none"> <li>■ Use cases beyond 5.9 GHz spectrum are well-defined and shared widely</li> </ul>	<ul style="list-style-type: none"> <li>■ 5 V2X use cases demonstrated utilizing the 5.9 GHz band</li> <li>■ 5 V2X use cases demonstrated utilizing spectrum beyond the 5.9 GHz band</li> </ul>	Private sector, with USDOT and IOO support
<b>Interoperability</b>	<ul style="list-style-type: none"> <li>■ Reference implementation for interoperable connectivity developed and delivered</li> <li>■ Reliable, scalable device certification processes utilized by multiple vendors.</li> </ul>	<ul style="list-style-type: none"> <li>■ 20 public agencies demonstrate interoperable connectivity</li> <li>■ SCMS credentials are in active interoperable use from 2 providers</li> <li>■ 10 certified devices on the market</li> </ul>	Private sector, with USDOT and IOO support
<b>Benefits and Technical Assistance</b>	<ul style="list-style-type: none"> <li>■ Report published documenting the cost-benefits of investing in V2X tech</li> <li>■ ITS community delivers a plan update on its progress towards national deployment</li> </ul>	<ul style="list-style-type: none"> <li>■ 6 use cases (2 involving vulnerable road users) document V2X safety benefits</li> <li>■ 50 active members of USDOT Accelerating V2X Cohort author progress report, spanning 25 states</li> </ul>	USDOT acts as clearinghouse, facilitates community

\* Each regional/corridor deployment spans a minimum of 300 miles of roadway (combined highway and surface street) and/or 300 intersections/interchanges.



**Table 4. Draft National V2X Deployment Plan by Strategic Focus Area (Long-Term, 2030-2034)**

Strategic Focus Area	Goals	Milestones / Targets	Lead Stakeholders
<b>Infrastructure Deployments</b>	<ul style="list-style-type: none"> <li>■ V2X interoperable connectivity deployed widely, seen as a fundamental element of system operations, and functions within a mature ecosystem featuring all stakeholders</li> <li>■ The National Highway System is fully deployed for freeway-based applications</li> <li>■ Top 75 Metro areas have 85% of their signalized intersections V2X-enabled</li> </ul>	<ul style="list-style-type: none"> <li>■ 50 corridor/regional deployments* with demonstrated interoperability and tested cybersecurity</li> <li>■ Interoperable 5.9 GHz operations demonstrated across 50 states</li> <li>■ 75% of the nation’s intersections have V2X technology installed across large, mid-size and rural communities</li> </ul>	IOOs and their partners, leveraging program funding
<b>Vehicles</b>	<ul style="list-style-type: none"> <li>■ Adoption of interoperable connectivity by infrastructure owners/operators and OEMs is widespread, including vehicle automation cases where applicable</li> </ul>	<ul style="list-style-type: none"> <li>■ 6 OEMs have 5.9 GHz capable production vehicles employing safety-related use cases</li> <li>■ 20 vehicle models are 5.9 GHz capable, including 12+ heavy/commercial vehicle models</li> </ul>	Private Sector (OEMs) and their partners
<b>Spectrum and Interoperability</b>	<ul style="list-style-type: none"> <li>■ Interoperability realized for use cases both within and beyond the 5.9 GHz spectrum, including vehicle automation where applicable</li> <li>■ Reference implementation for interoperable connectivity enhanced and maintained</li> <li>■ Certified devices dominate dynamic V2X technology base</li> </ul>	<ul style="list-style-type: none"> <li>■ 5 V2X use cases operational in the 5.9 GHz band in all 50 states</li> <li>■ 5 V2X use cases operational in spectrum beyond the 5.9 GHz band in 5+ states</li> <li>■ 20 certified devices dominate deployed V2X technology base</li> </ul>	Industry acts as champion for the V2X community
<b>Benefits and Technical Assistance</b>	<ul style="list-style-type: none"> <li>■ National benefits and costs pipeline established drawing from on data streaming from operational systems</li> </ul>	<ul style="list-style-type: none"> <li>■ 10 deployments in operations for 5+ years streaming benefits and cost data</li> <li>■ 75 active members of USDOT Accelerating V2X Cohort sponsor ongoing pooled fund projects spanning 45 states</li> </ul>	USDOT acts as clearinghouse, partners with pooled fund partners

\* Each regional/corridor deployment spans a minimum of 300 miles of roadway (combined highway and surface street) and/or 300 intersections/interchanges.

## Benefits and Challenges

The Draft National V2X Deployment Plan was created based on certain assumptions that could impact deployment. These high-level assumptions are highlighted below.

### Benefits

Evidence of the benefits of V2X technologies have been widely documented. A compilation of benefits can be found in the [ITS Deployment Evaluation](#) website. Examples include:

- The National Highway Traffic Safety Administration (NHTSA) [noted](#) that the implementation of just two V2X safety applications, Intersection Movement Assist (IMA) and Left Turn Assist (LTA) would prevent 439,000 to 615,000 crashes, 13 to 18 percent of the total, and save 987 to 1366 lives. The resulting savings from these reduced crashes would be \$55 to 74 billion.
- V2X can reduce CO2 emissions by up to 16 percent and platooning can reduce emissions by up to 33 percent. For an individual vehicle, an eco-driving application can provide an emissions reduction of almost 10 percent.
- An initial deployment of C-V2X in some Fulton County, Georgia school buses proved that fuel savings of more than 10 percent can be expected due to signal priority.

The Safety Pilot Model Deployment, the [Connected Vehicle Pilots](#), and other precursor V2X deployments have demonstrated the benefits of V2X communication using Dedicated Short Range Communications (DSRC). Based on these results, large-scale deployments with C-V2X and other communications technologies will provide significant benefits at a national level.

### Spectrum Use

Wireless spectrum is limited and in great demand. Low-latency, safety-related applications will utilize the 30 MHz in the 5.9 GHz spectrum reserved by FCC rule, while other applications will need to use other communication approaches, including solutions utilizing other spectrum. Various cellular communication-based approaches have been deployed, however, that are not interoperable across multiple supplier ecosystems.

### Coordination Across Jurisdictions

Interoperability allows people and goods to move seamlessly across borders, jurisdictional boundaries, and systems. V2X connectivity is envisioned as a cooperative system where technology operates as a single system despite various stakeholders, owners, operators, and equipment. Achieving interoperability requires close coordination across government and industry. The USDOT's standards and architecture includes the [National ITS Reference Architecture](#), a resource that provides a framework for safe, secure, and effective interoperable systems. The National ITS Reference Architecture continues to be updated over time as technologies evolves and is deployed.

## Private Industry Participation

To deploy connectivity to save lives requires coordination both with vehicles and infrastructure. Original equipment manufacturers (OEMs) will ultimately decide the extent to which V2X devices — such as onboard units — are installed in new vehicles. OEMs may not all have uniform views on the business case to invest in V2X technologies, but they may be influenced by other members of the private sector, government policies and actions, and public agencies deploying V2X infrastructure. Meanwhile, device manufacturers will have to ensure that roadside units and on-board units are developed appropriately with standards to ensure interoperability and have them tested and certified so that deployers (OEMs and IOOs) have certainty about going forward successfully.

## Public Agency Capacity and Funding

Public agencies like state departments of transportation and local agencies vary in their ability to deploy V2X technology. Some agencies lack expertise, institutional capacity, or funding; are using legacy systems; or have not made technology and innovation a priority. These differences need to be considered to support a collaborative and coordinated approach. Federal funds and assistance are available to support eligible deployments, but ultimately it is up to states, tribal governments, and local government to plan, design, construct, operate, and maintain systems and supporting infrastructure.

## Privacy and Security

Security is critical to ensure V2X technologies — and the information they provide — can be used and are trusted through standard procedures to validate that information is correct. That information needs to protect personal privacy while also allowing parties to secure the data needed to advance a safe and efficient transportation system.

## Near-Term Successes

Interoperable connectivity applications will continue to be developed with new use cases and innovations that build upon foundational technologies as well as deployment experience. In the near term, however, viable fielded interoperable connectivity deployments are needed to realize benefits and guide further development. The longer-term future possibilities are broader but will depend in part on achieving successes in the near term and the development of best practices, industry guidance, test procedures, and other components that support interoperability.

## Key Focus Areas Enabling Interoperable V2X Deployment

Figure 3 illustrates key focus areas that enable successful interoperable and cybersecure V2X deployments. More details will be provided in a forthcoming technical appendix.



Figure 3. Key Focus Areas Enabling Interoperable V2X Deployments

Source: USDOT

## V2X Community Stakeholders and Potential Actions

Stakeholder groups, including automotive OEMs and IOOs, came together to present a vision for V2X deployment, as shown in [a call to action prepared by ITS America](#) and released in April 2023. These collaborations are important to support peer entities and to present cross-industry perspectives to those who may not regularly interact with IOOs or OEMs. The collective voice of deployers plays an important role in conveying their willingness and desire to deploy. It also shows the growing market potential for industry to address and innovate.

Achieving the goals laid out in this Draft Plan depends on collaboration with multiple stakeholders. This section identifies major stakeholder groups (see [Figure 4](#)) and roles to clarify expectations, encourage dialogue, and coordinate activities. This framework is not an exhaustive list but shows examples of key roles and responsibilities. Stakeholders are encouraged to openly share their perspectives, plans, and commitments. The goal is to demonstrate the need for collective action to deploy V2X connectivity. No one group can achieve these goals on their own.

[Table 5](#) shows potential actions for major stakeholder groups.



**Figure 4. V2X Community Stakeholder Groups**

**Table 5. Potential Actions for Major Stakeholder Groups**

<p><b>USDOT</b></p>	<p><b>NTIA</b></p>	<p><b>Transit Operators</b></p>
<p>Provide federal leadership by hosting events and documenting a national vision and action plan for deployment.</p>	<p>Coordinate and convey federal (USDOT) interests in spectrum decisions and rules to FCC.</p>	<p>Deploy and operate on-board and center-based V2X applications to enhance transit safety, efficiency, and performance.</p>
<p>Provide seed funding and investment to accelerate V2X deployments.</p> <ul style="list-style-type: none"> <li>■ Launch a new program focused on V2X investment in 2023.</li> <li>■ Promote use of discretionary grant programs like ATTAIN, SMART, and SS4A grants to launch V2X deployments.</li> </ul>	<p><b>OEMs</b></p>	<p><b>Freight Operators</b></p>
<p>Convene and facilitate stakeholders to share information / best practices.</p>	<p>Develop, test, and deploy interoperable V2X safety applications.</p>	<p>Deploy V2X applications that provide internal return-on-investment, including safety and efficiency applications and driver support.</p>
<ul style="list-style-type: none"> <li>■ Establish an Accelerating V2X Cohort and document benefits, costs, and lessons learned.</li> <li>■ Fund detailed technical assistance training at conferences, annual meetings, and regional events.</li> <li>■ Operate training and equipment loan programs.</li> <li>■ Fund the Connected and Automated Transportation Coalition program.</li> <li>■ Update websites and the Smart Community Resource Center.</li> <li>■ Host regular webinars for training and to engage stakeholders as Plan is finalized and implemented.</li> <li>■ Enable interoperability through coordination with stakeholder groups and standards-related activities.</li> <li>■ Publish a final National V2X Deployment Plan in early 2024.</li> <li>■ Organize and deliver a 4th V2X Summit in 2024, specifically providing a venue for states and private industry to register their commitments to actions aligned with the Plan.</li> </ul>	<ul style="list-style-type: none"> <li>■ Initiate deployment of C-V2X technology and safety applications in new vehicles of all types (including fleet vehicles).</li> <li>■ Deploy interoperable safety and non-safety applications utilizing 5.9 GHz and other spectrum approaches.</li> <li>■ Actively partner with IOOs to enable national rollout of interoperable applications in production vehicles.</li> <li>■ Support precompetitive R&amp;D and standardization.</li> <li>■ Collaborate on message sets and standards for interoperability.</li> <li>■ Provide sustained input to FCC regarding impact of V2X technologies.</li> </ul>	<p><b>App Developers</b></p>
<p>Provide support for standards, architecture, and testing to accelerate interoperability.</p> <ul style="list-style-type: none"> <li>■ Conduct additional spectrum testing to provide data to FCC/NTIA to ensure release of FCC's Second Report and Order on C-V2X.</li> <li>■ Work with NHTSA to explore data-driven strategies that could effectively incentivize interoperable systems and accelerated deployment.</li> <li>■ Assess rules and guidance to ensure alignment with the Plan.</li> </ul>	<p><b>Automotive Suppliers</b></p> <p>Develop V2X-enabled vehicle components and applications for OEMs to include in production vehicles.</p> <p>Support precompetitive R&amp;D and standardization.</p> <p>Collaborate on message sets and standards for interoperability.</p>	<p>Design and develop applications that utilize connectivity.</p>
<p><b>FCC</b></p> <p>Work with USDOT and industry to determine rules for use of 5.9 GHz 30 MHz spectrum allocation to ITS services.</p>	<p><b>States, Local Governments, Tribes, and Public Agencies</b></p> <p>Update investment and transportation plans to include V2X technology.</p> <p>Deploy and operate interoperable, cybersecure infrastructure-based V2X technologies and applications.</p> <ul style="list-style-type: none"> <li>■ Leverage federal seed funding to inform and test interoperability.</li> <li>■ Collaborate on message sets and standards for interoperability.</li> <li>■ Work with local emergency services, transit, school bus, and other public sector vehicle fleets to enhance vehicle participation.</li> <li>■ Ensure interoperability is a routine element of state long-range and Metropolitan Planning Organization (MPO) plans.</li> <li>■ Participate in national events to remain up-to-date on V2X technology.</li> </ul>	<p><b>Service Providers</b></p>
		<p>Develop and operate supporting services that enable interoperable connectivity applications.</p>
		<p><b>ITS Equipment/Software Vendors</b></p>
		<p>Develop infrastructure-based components and software to fulfill public agencies' interoperable connectivity needs.</p>
		<p><b>Design/Integration/Deployment Consultants</b></p>
		<p>Provide support for public agencies to design, procure, integrate, and deploy solutions for interoperable connectivity.</p>
		<p><b>Security Credential Providers</b></p>
		<p>Provide security credential-related services (i.e., SCMS, certificates) to enable trust among interoperable connectivity entities and applications.</p>
		<p><b>Test Certification Providers</b></p>
		<p>Provide testing and certification services to enable trust in interoperable connectivity component functionality, performance, and standards conformance.</p>
		<p><b>Standards Development Organizations</b></p>
		<p>Develop standards to realize interoperability and support cooperative applications.</p>
		<p><b>Trade and Industry Associations</b></p>
		<p>Provide industry stakeholder feedback to inform USDOT and provide expertise.</p>
		<p><b>Communications Providers</b></p>
		<p>Build, operate, and maintain private communications networks to provide communications services to customers.</p>

## Future USDOT Actions and Support

To successfully accelerate this technology deployment to save lives and advance national goals, the U.S. needs to develop the workforce and skills critical to growing these systems. Growing the knowledge and skills of professional staff within public agencies is critical. Agencies are encouraged to assess their internal organizational capacity, gaps, and needs to plan a deployment approach that is tailored to their unique community.

USDOT will provide resources to public agencies and tribal governments to support the deployment of V2X technologies to save lives under the NRSS and Safe System approach. Below is a non-exhaustive list of resources and technical assistance the USDOT will offer to ensure the U.S. leverages connectivity to save lives. See [Table 6](#) for examples of USDOT-sponsored activities from research to deployment.

**Table 6. Examples of USDOT-Sponsored Activities from Research to Deployment**

Technical	Stakeholder Engagement	Professional Capacity Building
<ul style="list-style-type: none"> <li>■ Funding</li> <li>■ Mapping tool and technical support</li> <li>■ Architecture and standards development support</li> <li>■ Wireless interference testing</li> <li>■ Research on cybersecurity needs, connected vehicle analysis, modeling, simulations, digital infrastructure, and cooperative automation</li> <li>■ Project evaluation tools (and decision support resources)</li> </ul>	<ul style="list-style-type: none"> <li>■ Summits and workshops to provide updates on the Draft National V2X Deployment Plan and share information and best practices</li> <li>■ Documented best practices</li> <li>■ Pooled fund studies</li> <li>■ Coordination with USDOT modal administrations and federal agencies</li> <li>■ Stakeholder engagement with industry associations</li> </ul>	<ul style="list-style-type: none"> <li>■ Training</li> <li>■ Help desk</li> <li>■ Equipment loan program</li> <li>■ Cohorts and peer exchange programs</li> <li>■ Website and resource center</li> </ul>

The *V2X Deployer Resources* document currently being developed by the USDOT aims to provide deployers with a convenient and informative resource on the technical aspects of interoperable connectivity. The resource document also points to sources of more detailed technical information so that deployers can more easily find what they need to plan, develop, and operate interoperable connectivity deployments, as well as engage with the supporting technical working groups to share innovations and experiences. This document and lists of resources will be kept up to date over time with regularly updated content on the Smart Community Resource Center.

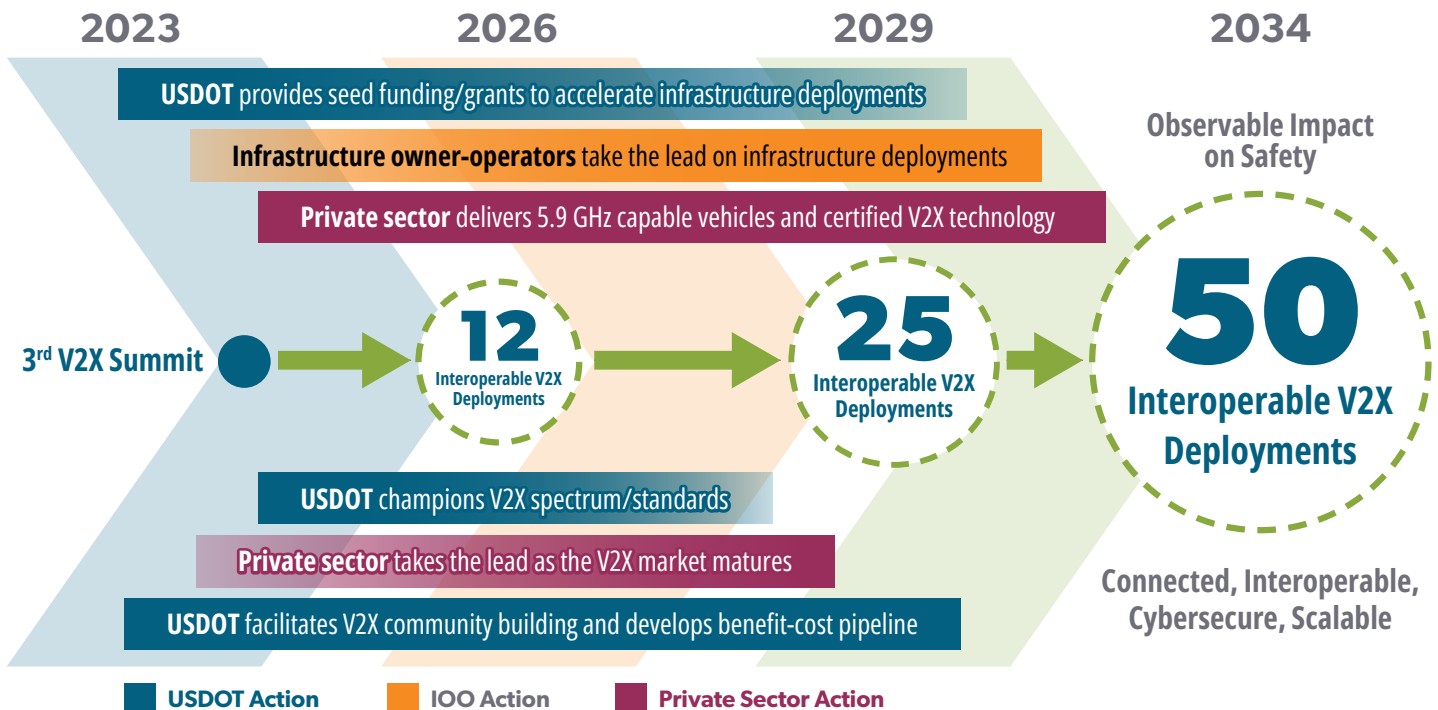
The USDOT also encourages the broader deployment community to be aware of other activities that can inform deployment planning and implementation and consider upcoming and longer-term innovations.

## Conclusion

This Draft National V2X Deployment Plan outlines a vision and path to deployment with the goal of saving lives through connectivity. Past V2X research and deployments show the promises of this technology. We must harness this opportunity now to realize these benefits today. The need for action is urgent. V2X is fundamentally a cooperative technology where the large-scale benefits are a magnitude greater as a whole than in an individual system. Achieving and sustaining interoperability is necessary to fully realize the benefits across a nation where vehicles and travelers span cities, states, counties, federal, and tribal lands. USDOT, public agencies, the private sector, and transportation operators need to take bold action in shaping the direction of the future. The USDOT remains committed to supporting and advancing the deployment of V2X technologies that enable the vision of a future with zero deaths or serious injuries. With this Draft Plan, USDOT commits to modernizing and transformation the future of transportation both for today and for tomorrow.

**V2X technology can improve safety on a national scale, and the time to invest is now.**

V2X connectivity is a critical transformational technology that not only advances safety but also enhances mobility, bolsters efficiency, and reduces negative environmental impacts. Accelerating V2X deployment now is a crucial step toward saving lives with connectivity (see [Figure 5](#)).



**Figure 5. Strategic, Coordinated Actions of Key Stakeholders Create Momentum Towards Interoperable V2X Deployments**

Source: USDOT