



PINGNET RESEARCH BRIEF

Safety Communication Insights for Connected Mobility

Distilling frontline perspectives from DOT leaders, industry experts, and everyday drivers to chart a path toward safer, connected roads.

Executive Summary

This report captures findings from a PingNet-led research initiative exploring how connected vehicle communication can improve road safety in a mixed-fleet environment. Through in-depth interviews with state and local DOT leaders, an industry expert, and an everyday driver, several clear themes emerged that should inform deployment strategy across the industry.



Deployment Barriers

Low equipment, funding gaps, and unclear standards slow V2X adoption



Trust Is Critical

Accurate alerts, authenticated data, and strong privacy protections are non-negotiable



Collaboration Required

Phased rollouts via agency-OEM-tech partnerships will drive scalable, interoperable systems





CHAPTER 1

Why This Study Matters

Roadway fatalities remain unacceptably high in the United States. New technology offers real promise – but only if solutions are shaped by the people who build, manage, and use our roads every day. PingNet initiated this research to move beyond a tech-first mindset and learn from those on the front lines: transportation officials, industry experts, and everyday drivers.

By understanding their experiences, concerns, and wish-lists, the goal is to shape connected vehicle solutions that genuinely address the gaps in current transportation safety systems – not just the ones engineers imagine from behind a desk.

The Mixed-Fleet Reality

For the foreseeable future, our highways will host a mix of traditional vehicles and advanced connected or automated vehicles. This creates a fundamental deployment question: **how do you implement safety communication when only a fraction of vehicles can "talk" to each other or to infrastructure?**

Our interviews tackled this head-on, asking agency leaders about their trials with connected vehicle pilots and what they need going forward.



Legacy Vehicles

The vast majority of cars on the road today lack any V2X capability, limiting network effects



Connected Vehicles

Newer models are beginning to integrate V2X, but penetration remains in the single digits



Infrastructure Gap

Roadside units and cloud platforms must bridge the gap between equipped and unequipped vehicles

Who We Talked To

We assembled a deliberately multi-perspective panel to ensure findings reflect the full ecosystem – from policy and operations to the end-user experience behind the wheel.



Public Sector Leaders

Utah DOT, Delaware DOT, Maricopa County DOT (Arizona), and the Eastern Transportation Coalition – representing regional diversity from mountain passes to dense East Coast corridors



Industry Experts

Industry Experts – experience at Zipline (drone delivery), Uber, and Twitter, bringing cross-industry lessons on fleet management and safety communications at scale



Everyday Drivers

Everyday Drivers – daily commuters whose real-world perspective ensures the end-user voice guides every recommendation

These perspectives were combined with recent research findings from Penn State and the Smart & Safe Transportation Lab presented at TRB 2026.



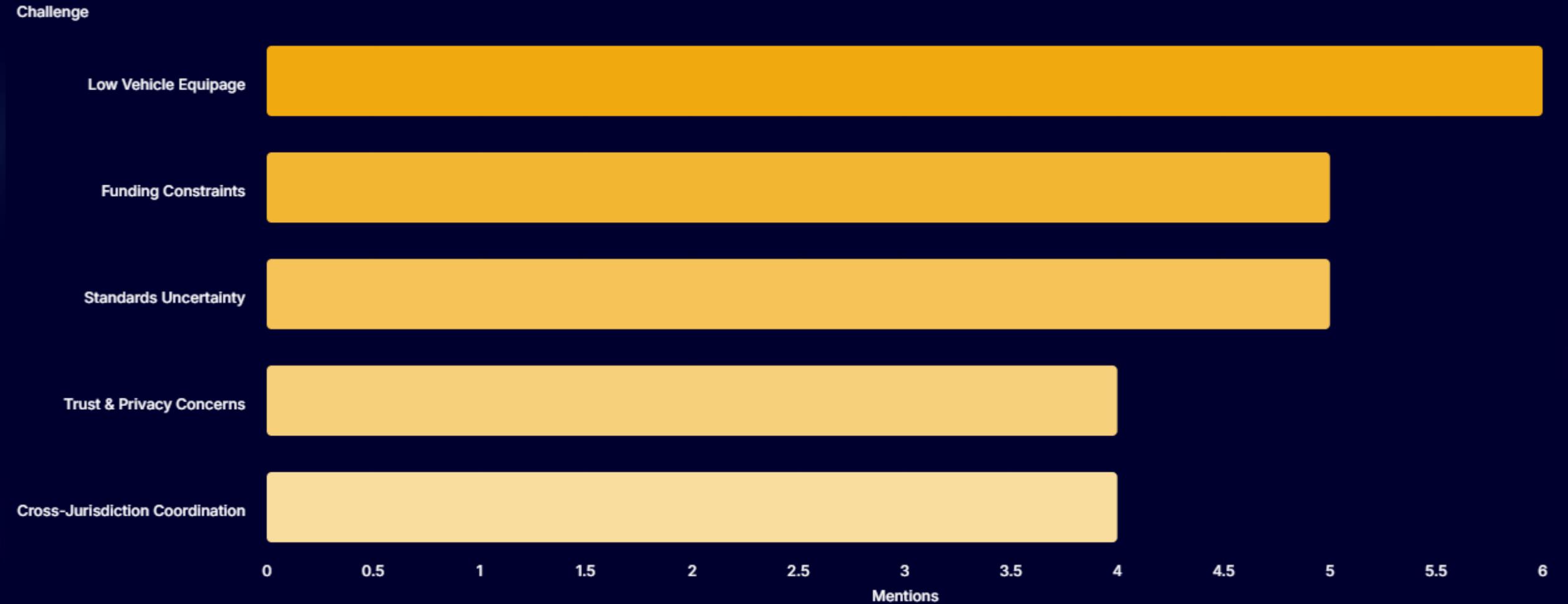
⚠️ CHAPTER 2 – DEPLOYMENT CHALLENGES

What's Holding Back V2X?

Even the most technology-forward agencies acknowledge significant barriers to deploying connected vehicle systems at scale. Our interviews surfaced five recurring obstacles that must be addressed before V2X can deliver on its promise.

Top Barriers to V2X Deployment

The chart below summarizes the challenges mentioned most frequently across our interviews.



These barriers create a reinforcing cycle: low adoption limits impact, which makes it harder to justify the investment needed to drive adoption higher.

Breaking Down the Barriers

Limited Vehicle Connectivity

Most cars on the road today simply cannot connect or communicate. You might equip an intersection to broadcast safety messages, but if only a handful of cars can receive them, the impact is negligible. Overcoming this will likely require mandates or incentives to accelerate V2X in new vehicles – **and aftermarket devices or apps for older vehicles.**

Standards Uncertainty

Some agencies invested heavily in DSRC radios, only to face FCC spectrum reallocation and the rise of cellular V2X. This whiplash has made DOTs wary. The Eastern Transportation Coalition highlighted the urgent need for vehicles, road infrastructure, and traffic centers to work together **across state lines** via open, interoperable standards.

Funding Constraints

As one DOT leader put it bluntly: *“Every dollar on experimental tech is a dollar not spent fixing a bridge or filling a pothole.”* Decision-makers need to see clear safety value to commit significant funds. Early deployments should target “quick wins” – demonstrating measurable crash reductions to build the business case for scaling.

Cross-Jurisdiction Coordination

Transportation doesn’t stop at city or state borders. An incident in one state can cascade into another. Agencies emphasized the importance of shared data, aligned strategies, and common platforms for message broadcast and security credential management through multi-state coalitions.

The Trust Gap with Drivers

Technology aside, **will drivers actually trust the system?** Several interviewees flagged that too many irrelevant or false alerts will cause drivers to tune out – or uninstall the app entirely.

Building credibility requires ensuring data is secure, user privacy is respected, and every alert sent is genuinely helpful and accurate.

"If an app requests too much access or needs permissions I can't understand, I won't use it. And if it pings me constantly with trivial info, I'll turn it off." –

Everyday Driver

Designing with the user's trust in mind isn't a nice-to-have – it's make-or-break for deployment success.

The Bottom Line

The challenges are substantial but known. The path forward involves working on multiple fronts simultaneously:

- **Policy** – standards and vehicle equipment requirements
- **Funding** – creative financing and public-private partnerships
- **Outreach** – educating the public on the safety vision



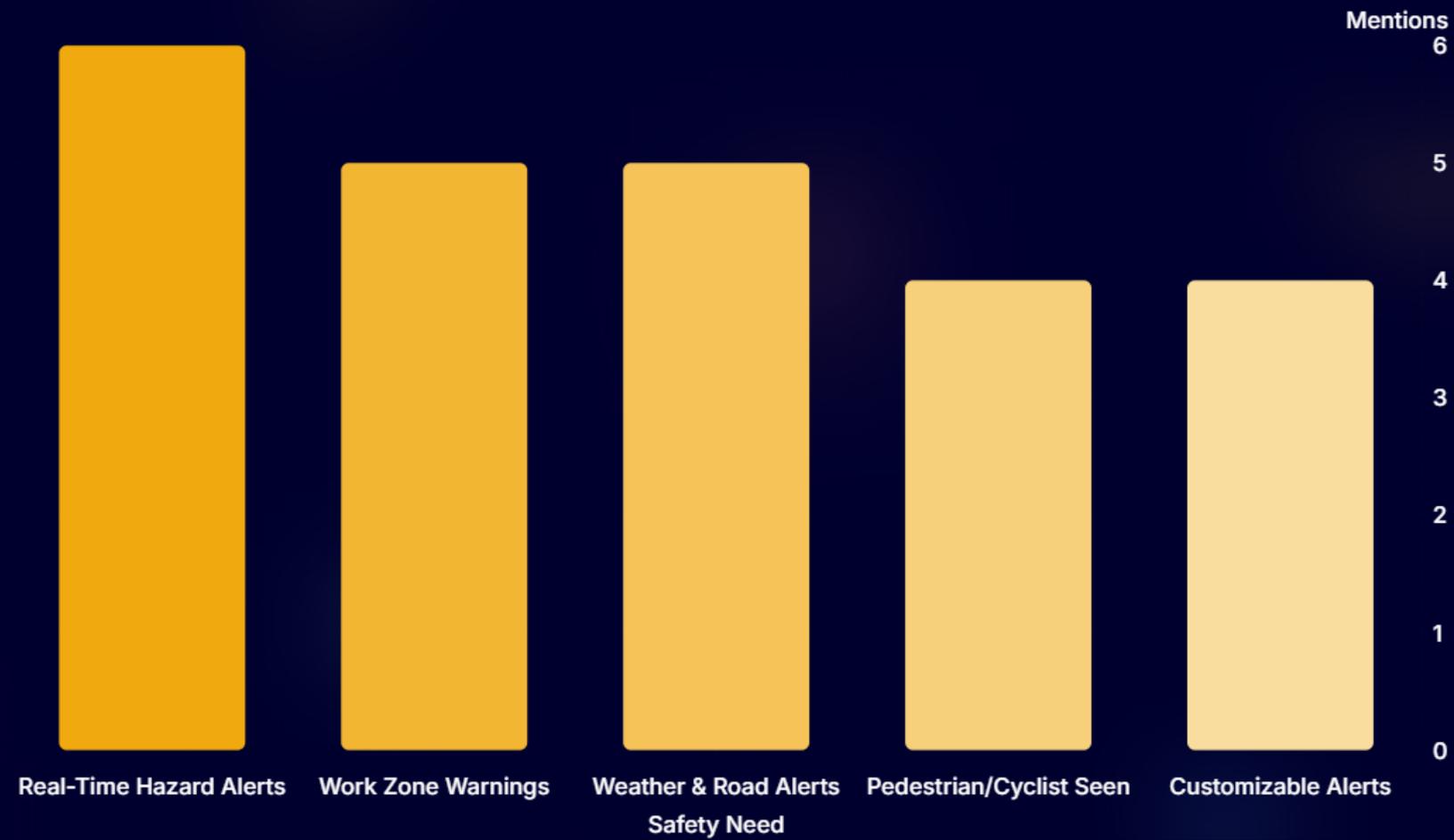
CHAPTER 3 – PRIORITY SAFETY NEEDS

What Do Users and Agencies Need Most?

Despite the roadblocks, there is strong alignment on the high-value use cases for connected safety communications. Both **industry experts** and the everyday driver in our study voiced a consistent need for **timely, context-specific alerts** that improve safety.

Priority Safety Information Needs

The chart below illustrates the top safety information needs mentioned across all interviews. Real-time hazard alerts emerged as the unanimous top priority.



Everyone agrees: if there's a crash or obstacle on the road ahead, a connected system should inform you **before** you encounter it. This is the killer app for V2X.

Deep Dive: The Five Core Use Cases



Real-Time Hazard Alerts

Prevent secondary crashes by warning drivers of obstacles, collisions, or sudden stops before they encounter them – especially in low-visibility conditions like fog or heavy rain.



Trust & User Control

Quality over quantity. Tiered alerts by severity, customizable preferences, and distinct audio signals for different urgency levels keep the system credible and usable.



Work Zone Warnings

Dynamic alerts as drivers approach construction zones – far more effective than static signage. Advanced setups could connect to smart vests to alert drivers coming up too fast.



Pedestrian & Cyclist Safety

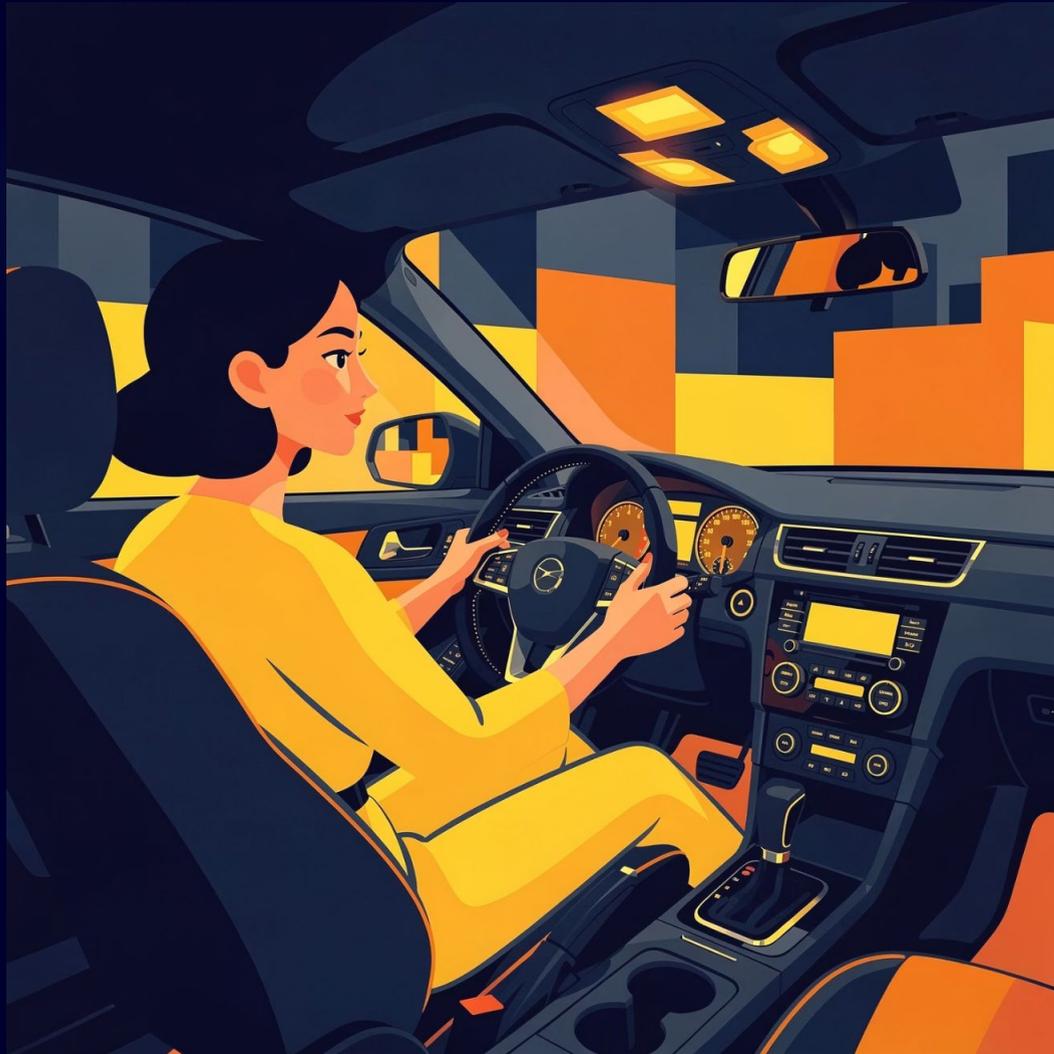
Geo-fenced zones around schools and downtown crossings can send advisory alerts like "High pedestrian activity – drive with caution" to approaching drivers.



Weather & Road Conditions

Move from broad advisories to precise, location-based alerts. If multiple vehicles trigger ABS at the same spot, infer ice and warn vehicles still 10 miles back.

The Driver's Perspective: What Everyday Drivers Told Us



The everyday driver represents the ultimate customer for any safety app or connected system. Their insights cut through the technical complexity and reveal what will actually drive adoption:

"I want a heads-up if my route has an unexpected issue — a closure or accident — because it lets me avoid getting into a stressful situation."

"Different chimes for different alert levels would help me instantly know: is this urgent danger, or just a heads-up?"

"I'm okay sharing anonymized info to help the community — as long as it's clearly for improving safety."

The message is clear: if a connected safety service can reduce anxiety, avoid accidents, and respect privacy, **users will come.**



🔒 CHAPTER 4 – BUILDING TRUST

Security, Authenticity & Context

A recurring theme across every interview – especially from the industry expert – was the fundamental importance of trust. Without it, even the best technology will fail. Two distinct layers of trust must be addressed simultaneously.

Two Layers of Trust

System Trustworthiness (Technical)

Communications must be secure and verified through digital certificates (PKI for vehicles). An industry expert drew an analogy to Twitter's verification challenges:

"Sorting real vs. fake was a constant battle." For V2X, this means investing in authentication and having mechanisms to flag faulty data – like a malfunctioning vehicle broadcasting erroneous crash alerts. **Reliability is king for safety messages.**

User Trust & Understanding (Human)

Even a secure system falls flat if users don't understand or believe it. Alerts must be presented clearly and contextually – a "hydroplaning risk" alert makes sense during a rainstorm on a highway segment known for pooling, not on a sunny day.

Smarter, context-aware systems will have fewer false alarms and maintain credibility over time.

📄 **Transparency matters.** Agencies should be open about what data is collected and why. If location data is used to generate warnings, ensure it's anonymized and used for the public good – and communicate that clearly. Keeping the framing on safety and community benefit will maintain public support.

Designing for Credibility

TRB 2026 research confirmed that driver acceptance varies with context – people appreciate automated help in intense situations but may resist it during routine driving. This suggests rolling out features in ways that clearly demonstrate benefit during high-stakes moments, turning early adopters into evangelists.

Moving Forward: A Multi - Pronged Strategy

The interviews and research converge on a clear strategic framework: **start small, prove value, build partnerships, and scale methodically.** No single agency, OEM, or tech provider can do this alone – but together, the pieces fall into place.

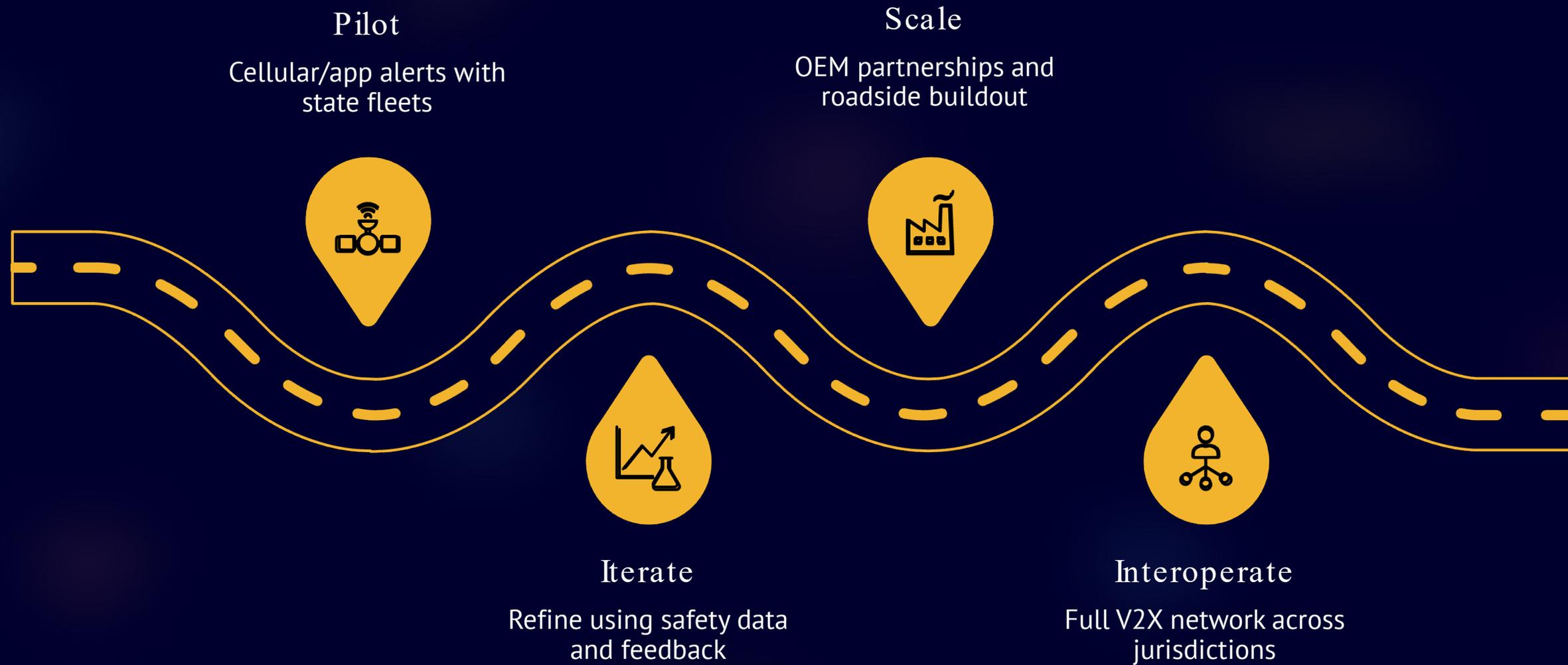


Five Strategic Imperatives

- 1** Start with Pilot Programs
Test in controlled environments – a specific highway corridor or city zone outfitted with tech and equipped vehicles (state fleets, buses, freight). Utah DOT might begin with a mountain pass to send weather and crash alerts to truck drivers. **Measure outcomes:** reductions in sudden braking, secondary crashes prevented.
- 2** Iterate & Improve Continuously
Borrow from software industry practice: treat deployments as evolving products. Gather user feedback. Were alerts useful? Too frequent? An industry expert's insight: *"Constant iteration and feeding lessons back in is key to scaling a reliable operation."* Update thresholds, message phrasing, and UX based on real-world data.
- 3** Forge Cross-Sector Partnerships
Automakers can integrate alert displays in instrument panels or HUDs – far more effective than a phone notification. Tech startups bring innovative platforms. Link in first responders so firefighters approaching an accident can broadcast alerts to clear civilian vehicles. **The more players connected, the more powerful the network effect.**
- 4** Advocate for Smart Policy
Federal leadership in mandating or standardizing V2X would clear enormous confusion. Advocate for requiring basic V2X capability in new cars by a target date, allocating dedicated spectrum, and sustained V2X infrastructure funding. Safety is bipartisan – and with traffic deaths rising, there's political momentum.
- 5** Engage the Public Early
Run public pilot demonstrations, invite media, and clearly communicate benefits. A campaign like *"Vehicles Talking = Safer Roads"* makes the concept accessible. The technology is complex, but the idea is simple: share information in real-time so everyone makes safer decisions.

The Deployment Roadmap

A phased approach bridges the gap between today's mixed-fleet reality and tomorrow's fully connected network – leveraging existing technologies now while building toward dedicated V2X.



Each phase builds on the last. Interim solutions leveraging ubiquitous smartphones, cloud computing, and advanced vehicle sensors can create an initial safety net that begins saving lives **sooner rather than later**.

CONCLUSION

The Road Ahead: A Shared Vision for Safer Mobility

For DOT leaders, industry experts, and collaborators, the message from this research is hopeful: **there is a strong, shared vision for safer, connected mobility**. The obstacles – technological, financial, organizational – are real but not insurmountable.

Start Small

Pilot programs prove value and build the evidence base for scale

Build Trust

Every alert, every data practice, every interaction earns or erodes confidence

Partner Broadly

DOT leaders + industry experts + the everyday driver = unstoppable network effects

Stay User-Centric

Success will ultimately be judged by the everyday driver – if it makes them safer, they'll embrace it

Every incremental step – a pilot here, an equipped fleet there, a new standard agreed upon – adds up. By continuously aligning technology with real user needs, we can ensure connected vehicle communication achieves its lifesaving potential.

CLOSING

Thank You

Your insights and expertise make this research possible.

Get In Touch

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Join Future Research or Collaboration

We're actively recruiting participants for our next phase of research on connected vehicle safety communication. We're also looking for agency partners, fleet operators, and industry collaborators to participate in upcoming connected vehicle safety pilot programs. Whether you want to contribute to research, join a pilot, or explore a collaboration, we'd love to hear from you.