- Ohio Smart Mobility Corridor Honda Connected Vehicle Pilot Program Update

- SAE V2X Standards Update

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- Smart Mobility Corridor
  - Our Objective
  - Infrastructure Growth
  - Key Learnings
  - Other Immediate Benefits
  - Challenges to the Frequency Spectrum
  - Looking Ahead
  - A New Connected Corridor (Up North)
- SAE V2X Standards Update

- Smart Mobility Corridor

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Gather highly valuable V2X interaction data to contribute to future CV system design

Raw Data

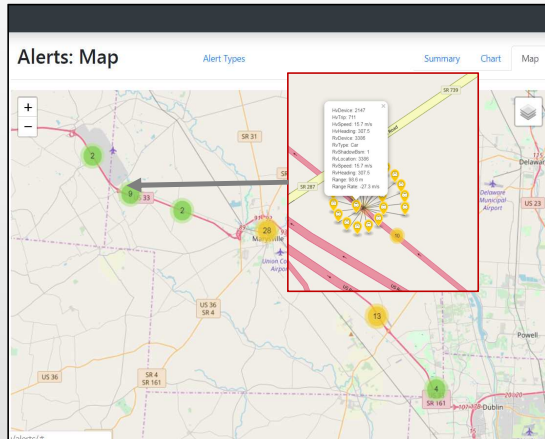| V2X Data	
General	Vehicle type, location, time, etc.
Motion	Heading, speed, acceleration, brake status, light status, airbag status, wiper status, etc.
Path history	
Path prediction	

V2I Data	
Infrastructure type, location, time, etc.	
Traffic signal status	
Roadwork detail (lane affected, location, duration, etc.)	
Severe weather information	

Data Server

Analysis Results

Example:
V2V Interaction Location and Duration
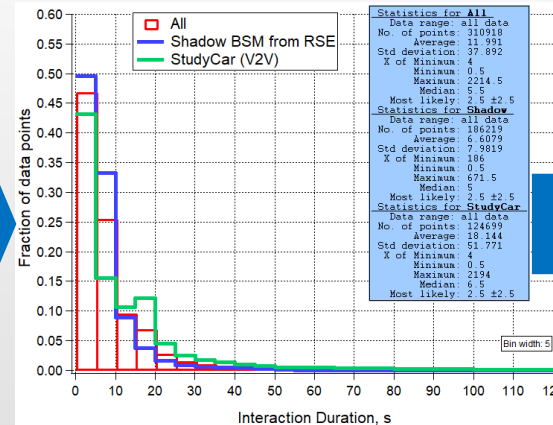
Future CV System Design

- Density-sensitive app selection
- Effectiveness validation
- Driver expectation

Infrastructure Growth: The Beginning (2017 – 2018)

- A limited number of connected vehicles
- Honda, ODOT, and the City of Marysville built two smart intersections

SMART INTERSECTION

Infrastructure Growth: Present

- More than 100 Honda connected vehicles
- ODOT is adding more infrastructure as we speak
- The City of Marysville added several smart intersections

US-33/739 Smart Intersection

Dublin V2X Environment

SMART INTERSECTION
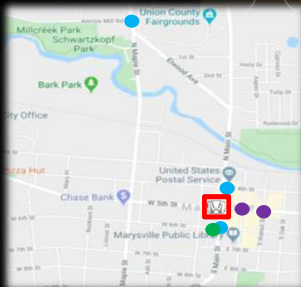
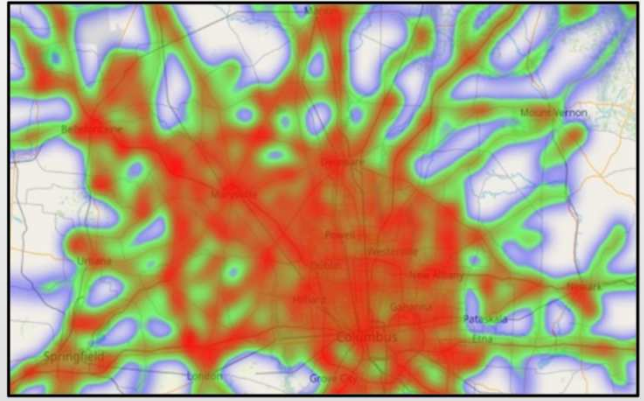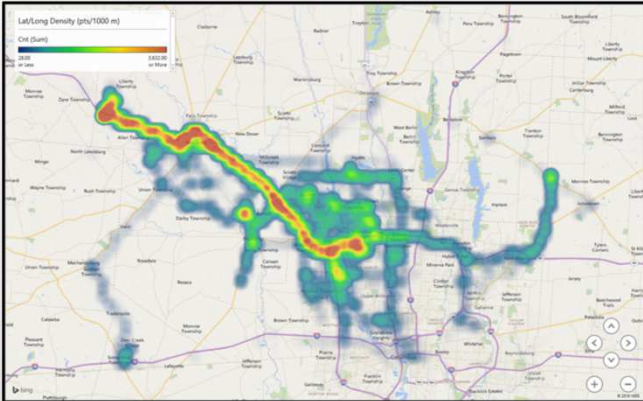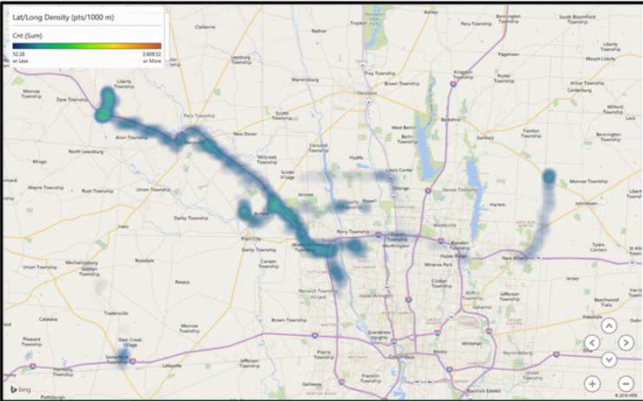# More Vehicles = Many More Interactions

5 Vehicles ➡ 25 Vehicles ➡ 119 Vehicles (Peak)

(Through April 2020)

119 Fleet Vehicles (Peak)

739,001 Miles Traveled

59,806 Trips

Vehicle-to-Vehicle Interactions	Driver Warnings	Smart Intersections	Signal Phase and Timing (SPaT) Intersections
		Count: 2	*Count: 49*
103,934	**1,540**	**153,464**	**13,099**
Honda Vehicle Interactions	Total Warnings	Infrastructure Assisted Detection of Non-V2X Road Users (and some non-Honda CV interactions)	Vehicle-to-Infrastructure (V2I) Interactions
			4,679
			Red Lights Encountered by Study Vehicles
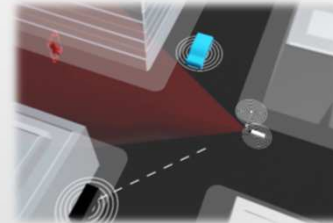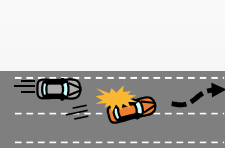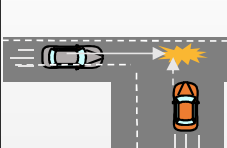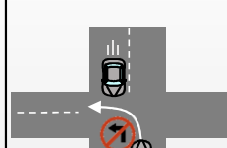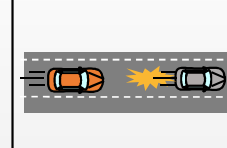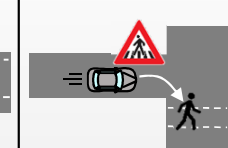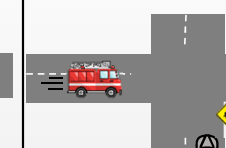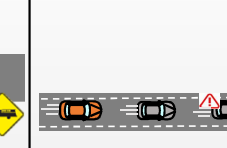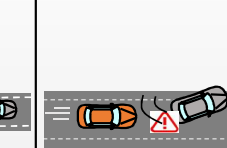
(Through April 2020)

1,540 Total Warnings

1,346 Inform Warnings

194 Imminent Warnings

	Warnings Breakdown							
Warning Type	Blind Spot/Lane Change Warning	Intersecting Collision Warning	Left Turn Assist	Forward Collision Warning	Pedestrian Detection Assist	Emergency Vehicle Alert	Emergency Brake Alert	Control-Loss Warning
Inform	659	544	76	53	0	4	4	6
Imminent	11	96	27	16	21	17	6	0
Total	670	640	103	69	21	21	10	6

- Honda is working with ODOT to bring new vehicle-to-infrastructure (V2I) applications and warnings

Our research shows mobility benefits even at a low-V2X-density environment

Information from V2X-equipped vehicles ahead

⬇

Lane-level traffic speed estimation

⬇

Decision-making of lane change and recommendations to the driver
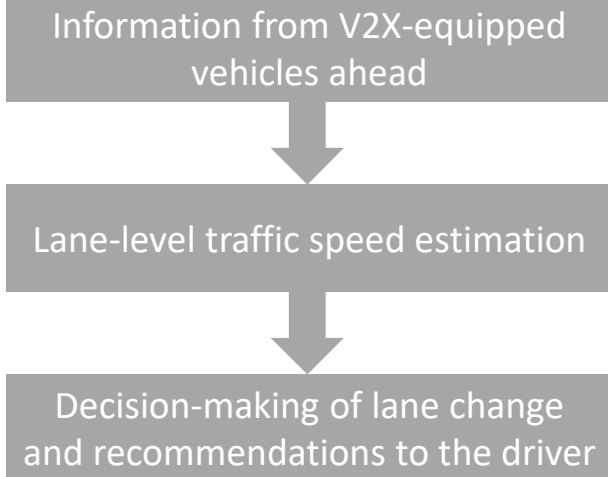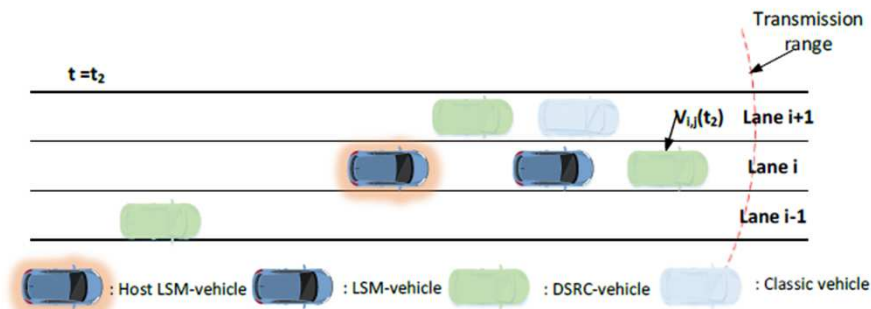
Speed Improvement by Lane-Speed-Monitor
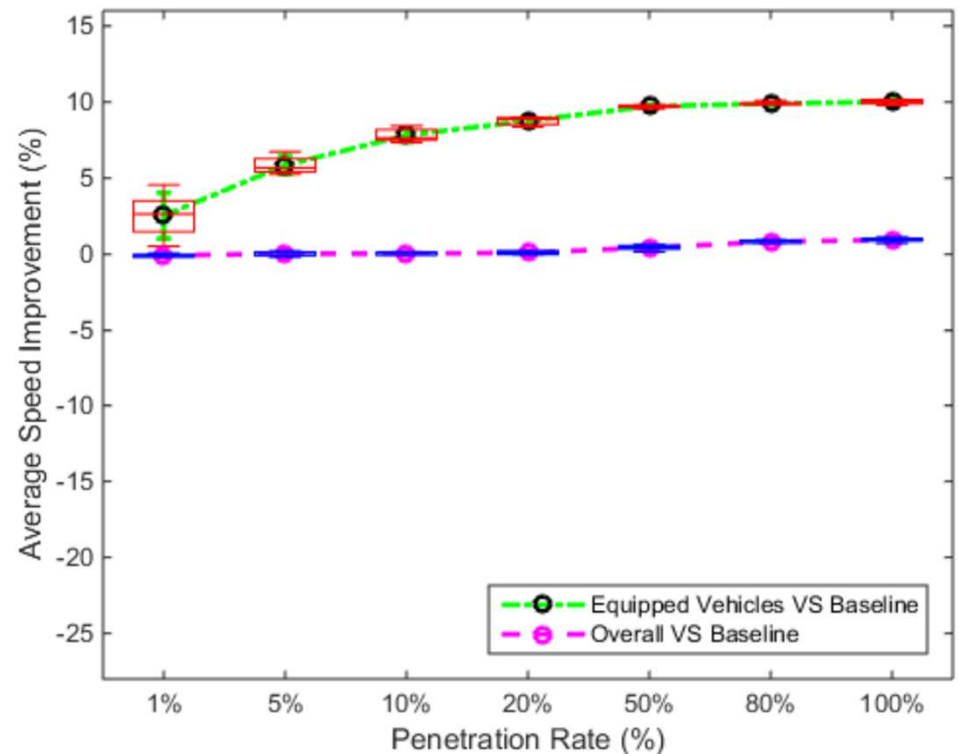
- **FCC plans to open most of the 5.9GHz V2X spectrum** to unlicensed use (final decision targeted for October '20)

- **Significant interference (↔) impacting V2X performance** is expected

- **7 DSRC** Channels → **3 DSRC / LTE V2X** channels

- Industry is actively engaged with FCC to strengthen the message:
Preserve all 7 channels at 5.9GHz exclusively for V2X safety use

Alliance for Automotive Innovation
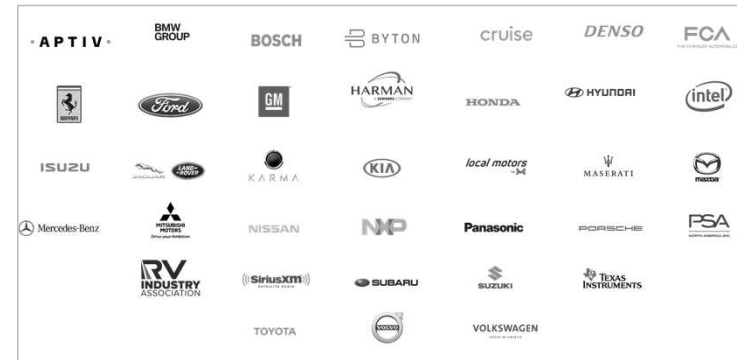
DSRC → Dedicated Short Range Communication
LTE → Long Term Evolution (Broadband)

5.9GHz Spectrum

	5.855 GHz	5.865 GHz	5.875 GHz	5.885 GHz	5.895 GHz	5.905 GHz	5.915 GHz	5.925 GHz
	CH 172	CH 174	CH 176	CH 178	CH 180	CH 182	CH 184	
Current ➡	**DSRC** V2V Safety	**DSRC** V2I Safety	**DSRC** V2P Safety	**DSRC** Control	**DSRC** Service	**DSRC** Service	**DSRC** Safety	↔ Unlicensed
FCC Proposal ➡ (Notice of Proposed Rulemaking)	Unlicensed (WiFi)				↔ **DSRC / LTE-V2X**	LTE-V2X	LTE-V2X	↔ Unlicensed

Looking Ahead: Expand CV Environment as Technology and Infrastructure Mature

- Targeting 200 CV-retrofit vehicles by early 2021
- Add more V2I applications to support ODOT, Marysville and other infrastructure providers
- Open to working with new collaborators and new concepts

Phase 1 (2017-2018/09)
Initial 20 CV trial fleet

- 20 vehicles trial
- Data and OTA server build
- 2 Smart Intersections

Phase 2 (2018/09-2020/12)
Target low-density environment build

- 200+ Connected Vehicles
- More Infrastructure-Vehicle applications
- Application effectiveness data analysis

Phase 3 (2020/12 →)
Maintain and extend as needed

- Maintain and extend Honda CV fleet
- Ensure interoperability with collaborators' CV fleet
- Explore new applications

# A New Connected Corridor: Michigan's New CAV Corridor

- **Michigan DOT announced a new CAV corridor program**
  - → Focusing on CAV deployment with large-scale infrastructure support
- **A great new opportunity to work together**
  - → Accelerate CAV deployment in the Midwest region
  - → Maintain each state's uniqueness and regional-specific transportation needs

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Scope: Develop and maintain V2X message set and application standards
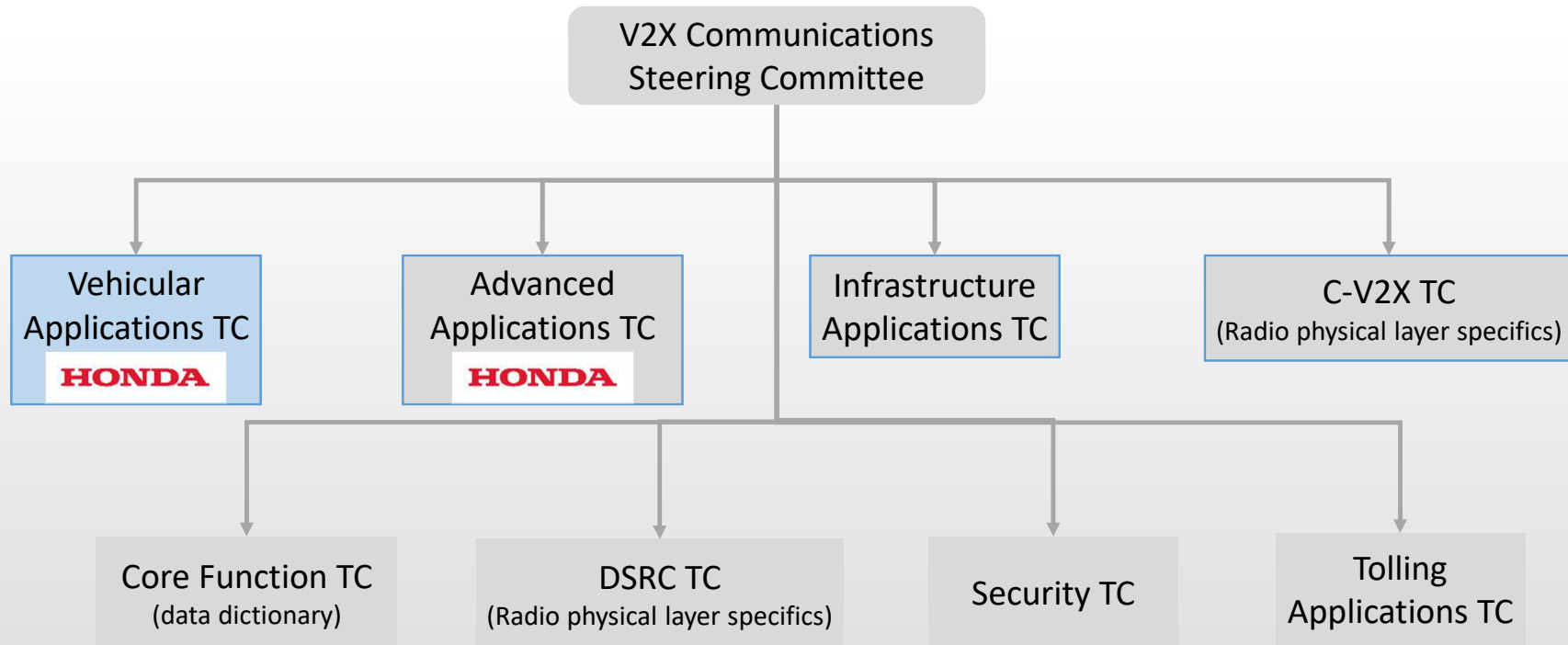

TC: Technical Committee

- Enhance Adaptive Cruise Control (ACC) with V2X communication
- New message on dedicated channel to ensure performance and minimize congestion impact from other V2X application transmission
- Include platooning as Phase 2
- Balloting scheduled to start this year
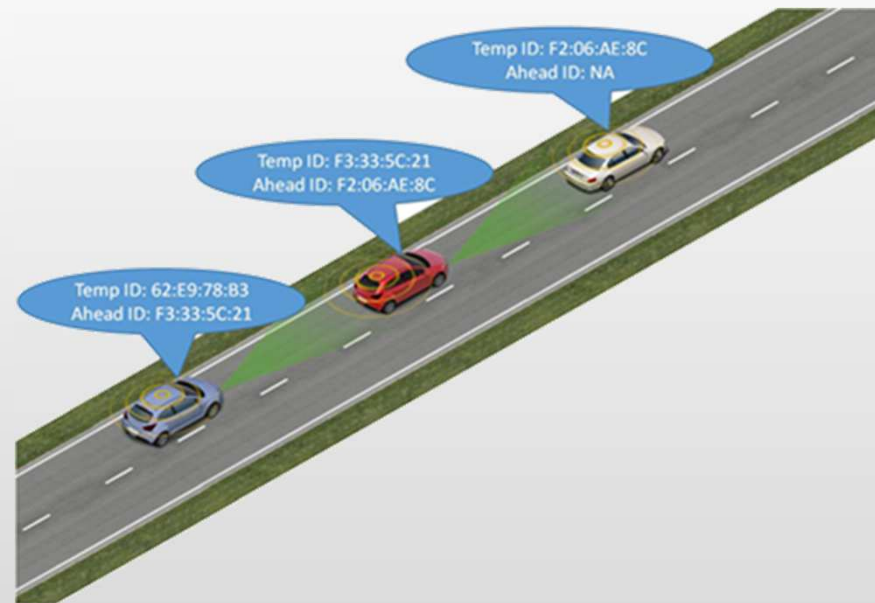
- Vehicle/Infrastructure perception data sharing to enhance ADAS/ADS situation awareness
- Reuse V2V safety message types with different message types and requirements
- Great benefit to V2X early deployment
- Balloting scheduled to start this year

Example: Infrastructure detects pedestrian and shares information to V2X-equipped vehicles

There is a pedestrian crossing the street
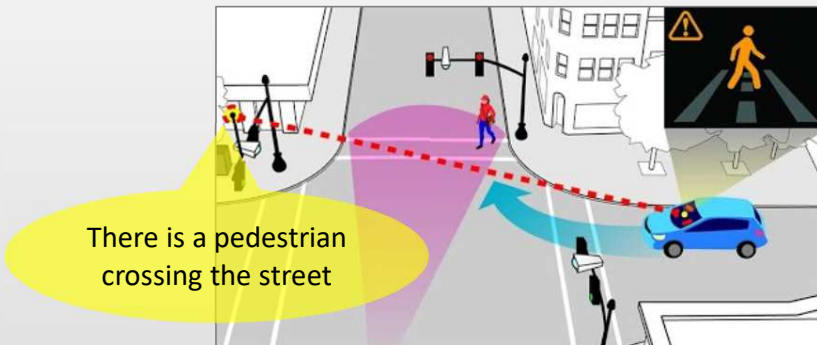
Example: Vehicle front camera detects non-V2X lead vehicle and shares information to V2X-equipped nearby vehicles

There is a vehicle coming your way
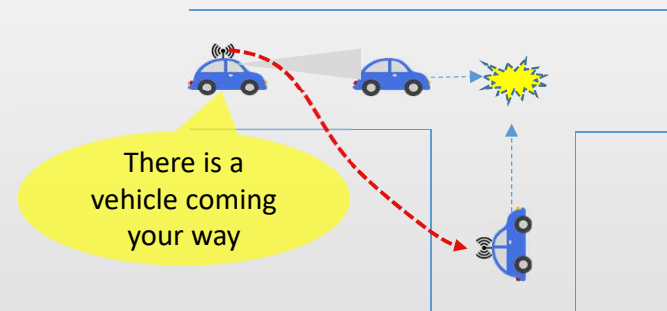
- Enhanced communication between road users has the potential to improve overall road safety
- Define use cases and message protocol for road users and infrastructure to exchange intention and needs
- Plan to start ballot in 3-4 months

Current Situation: Ineffective Communication

Road User to Road User Courteous Communication

Summary

- Honda is committed to **expanding CV fleet deployment** and **collaborating with Smart Corridor stakeholders**

- **Let's work together** to **protect the V2X spectrum** for transportation safety

- As leaders in the Midwest region, let's **collaborate** with our Northern neighbors **to help improve transportation safety and improve society**

- Honda is leading SAE V2X vehicular standards development to **expand safety and mobility benefits to a variety of road users**

- We **welcome inputs** from the stakeholders to **refine the standards**