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Intelligent Transportation System (ITS) Applications and Automated Technologies for Motorcyclists

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Agenda

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- Project Overview
- ITS Applications: Connectivity, Automation, and ARAS
- Potential Impact
- Study Results

Project Overview

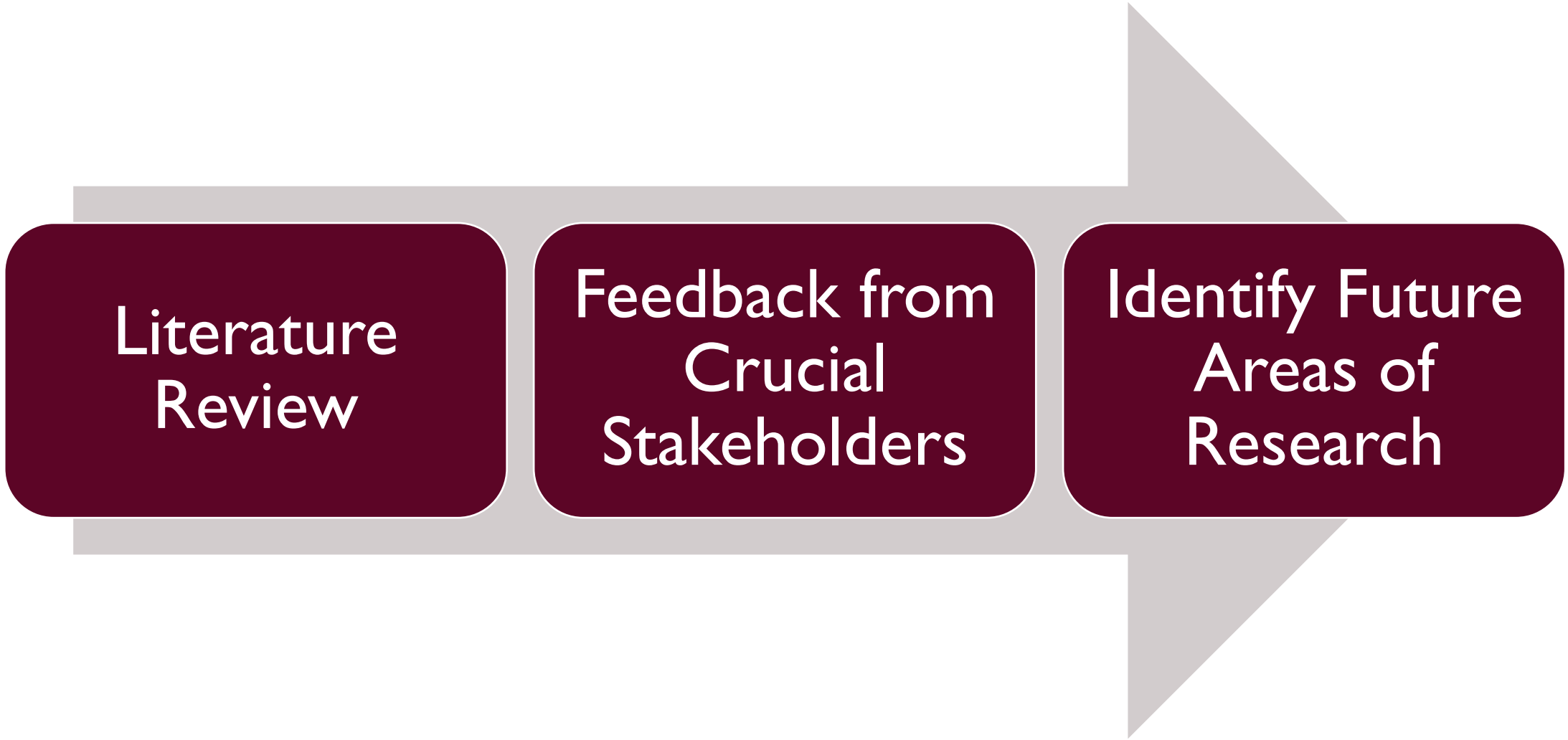
Research Objectives

1. Understand **state of practice** of Advanced Rider Assistance Systems and Cooperative Intelligent Transportation Systems for motorcycles

2. Understand **current state of knowledge** of these applications among crucial stakeholders

3. Identify **challenges and research gaps** and provide recommendations for future research paths

Project Overview



ITS Applications: Connectivity, Automation, ARAS

Terminology

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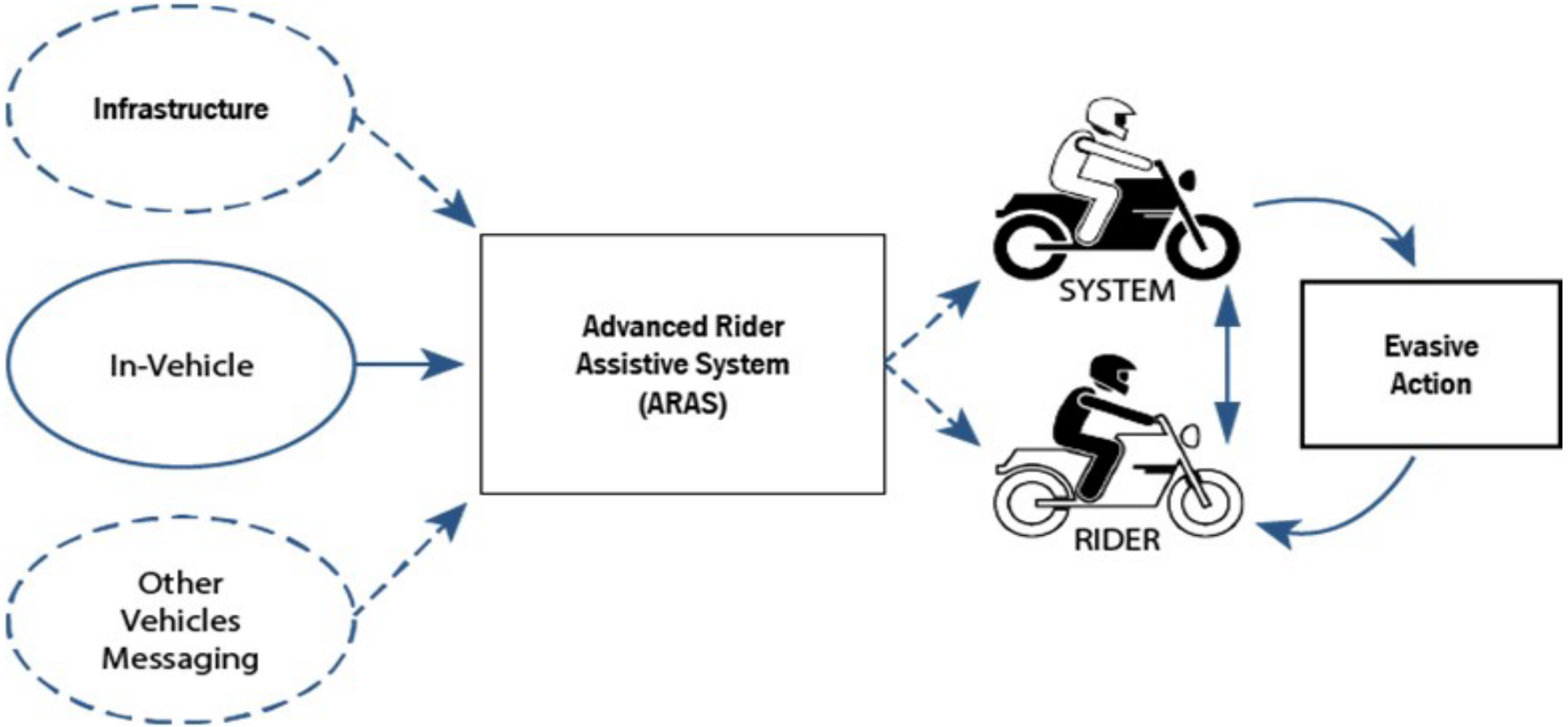
Connected Vehicle Technology (CV)	• Vehicle to Vehicle (V2V), Vehicle to Infrastructure (V2I), Vehicle to Everything (V2X)
Automated Vehicle Technology (AV)	• Vehicles capable of automatically performing driving tasks • Various Levels of Automation
Advanced Rider Assistance Systems (ARAS)	• Denotes equipment that supports and assists the motorcyclists like ADAS • For example, anti-lock braking, combined braking systems, blind-spot assist, adaptive headlights, curve warning systems, etc.

Terminology



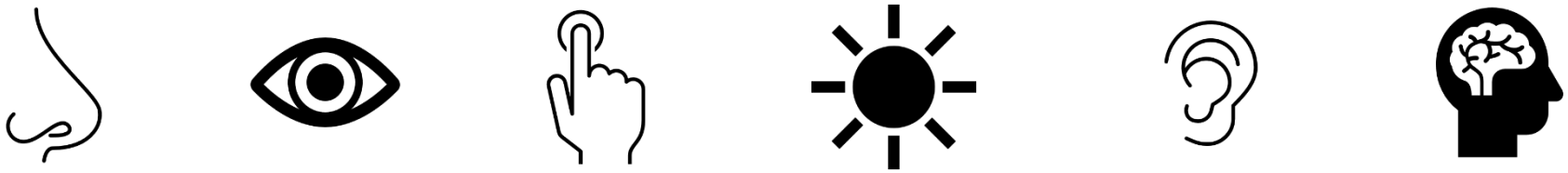
Potential Impact

Understanding the Need

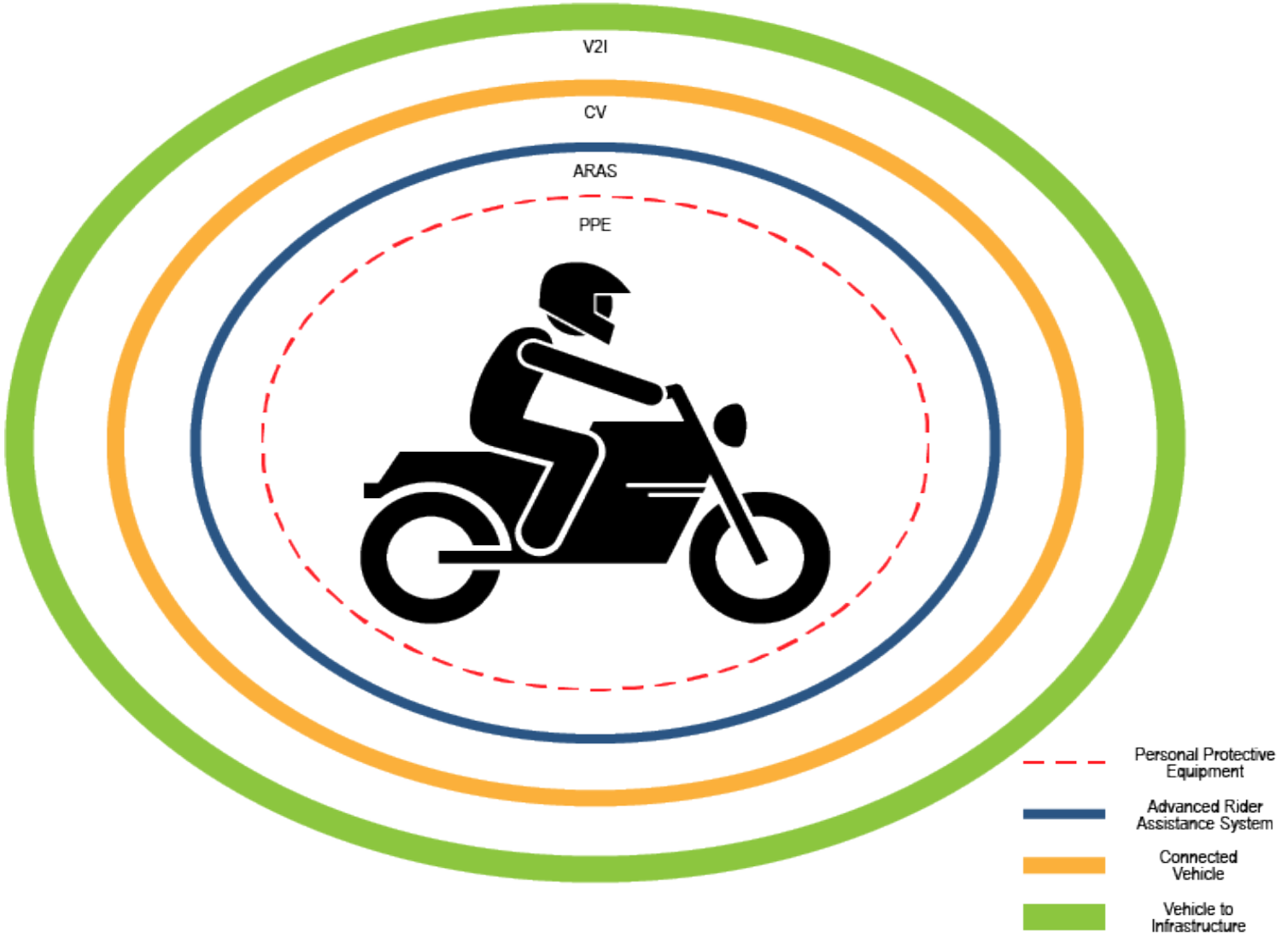
- Motorcyclist fatalities and crashes are overrepresented
- The World Health Organization (WHO) found that injury among motorcyclists is a global health problem, with nearly 300,000 annual deaths worldwide (WHO, 2015).
- In the United States, motorcycles make up 3% of registered vehicles but account for 14% of all traffic deaths (NHSTA, 2021).
- 25.47 motorcyclist fatalities per 100 million VMT (vehicle miles traveled) vs .89 passenger car deaths per 100 million VMT

Understanding the Need

- Motorcycles are less forgiving than passenger vehicles and possess less traction.
- Errors made by the motorcyclists are primarily perception and execution failures (Penumaka, 2014).
- One study found that motorcyclists experience more strain by at least 1.7-fold for every sensory input (Kuschefski, 2011).

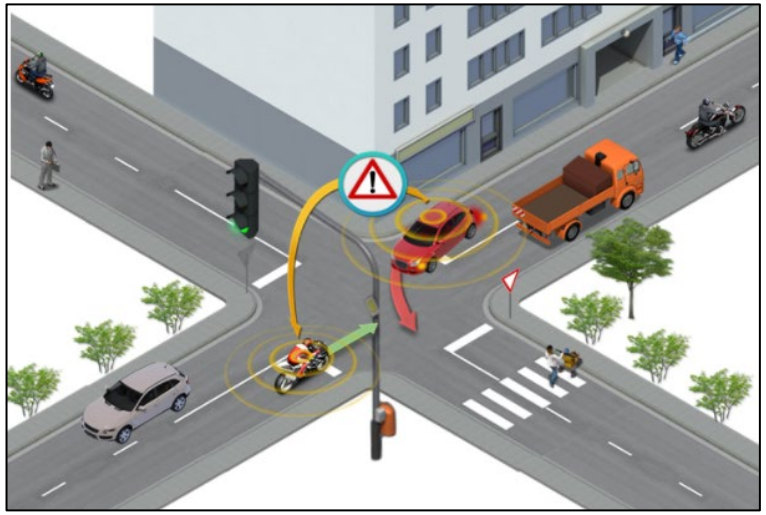


ARAS and Connectivity

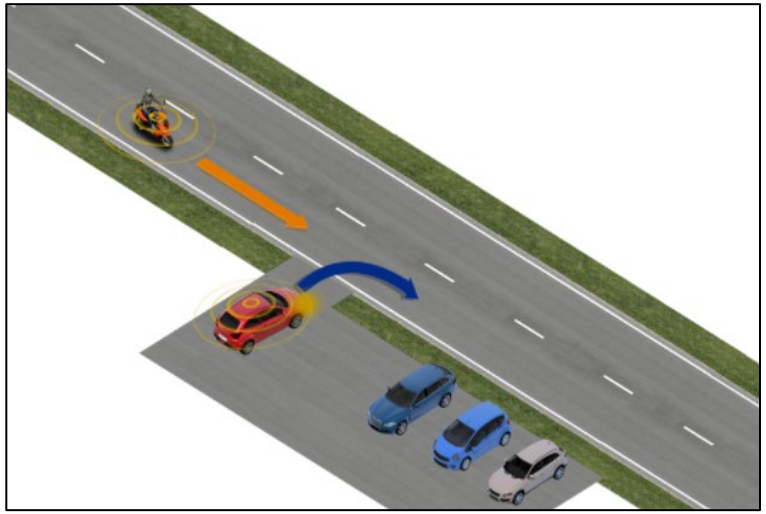


Potential Benefits

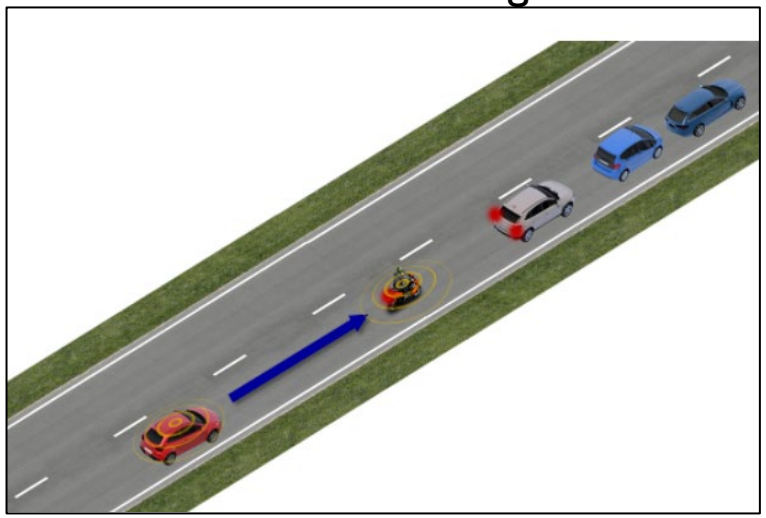
Left Turn Assist



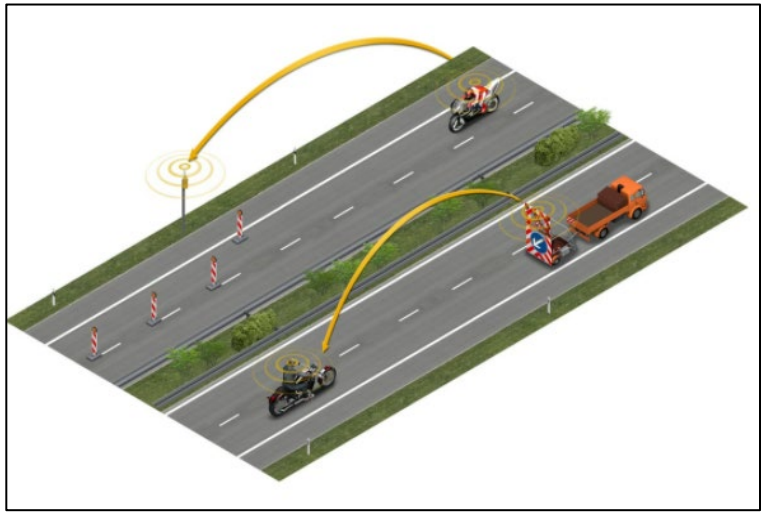
Intersection Movement Assist



Forward Collision Warning



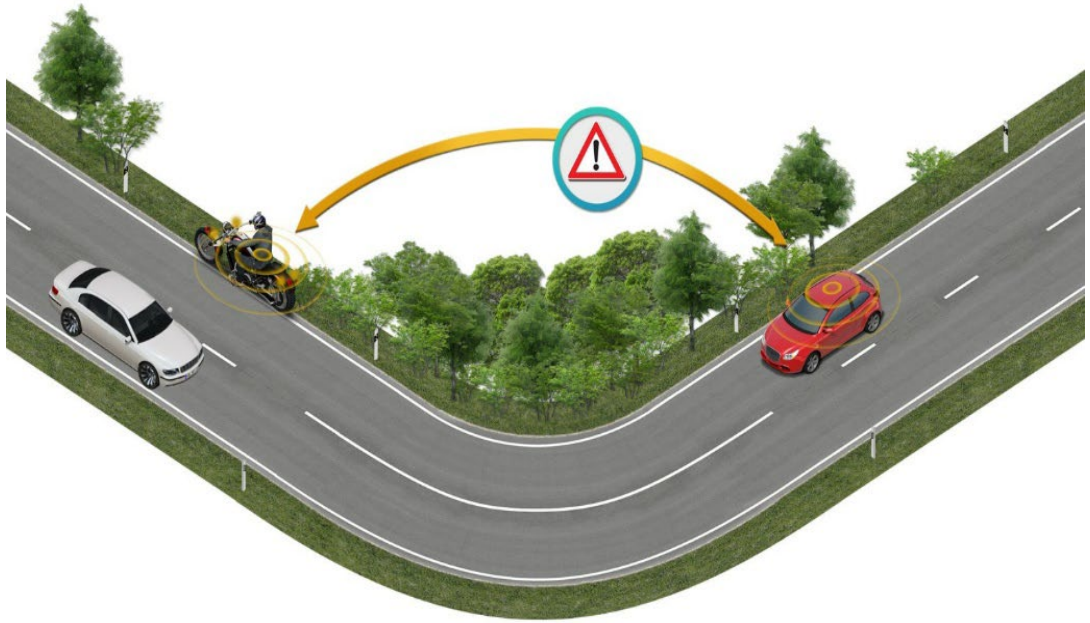
Road Works Warning



Review of Literature and Focus Group Results

Literature Review Results

- **Warning and Intervention Mode and Timing**
  - Distracting
  - Overwhelming



- **Design Concerns**
  - Small Surface Area
  - Capable of Lean
  - Sits Low

- **Motorcycle Connectivity vs Passenger Vehicle Connectivity**
  - Comparative Safety Analysis

Agency Listening Session

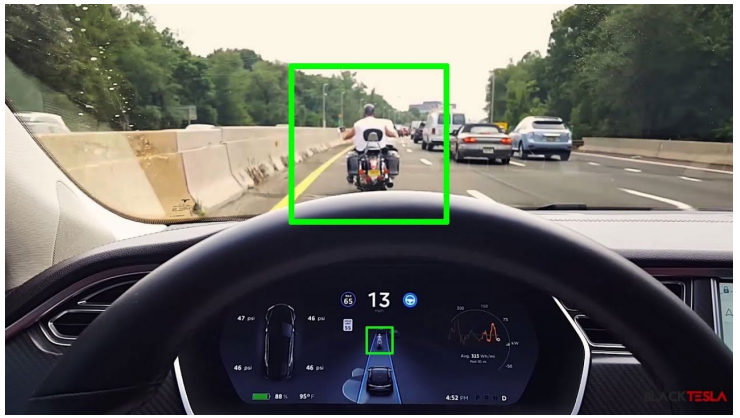
- A 90-minute listening session was conducted with key federal agencies.

- During the listening session, participants were asked to share their first research priority on motorcycle connectivity.

- FHWA and NHTSA staff identified the following top five priorities.
  1. Equipped Vehicle and Driver Detection of Motorcycles and Accuracy
  2. User Acceptance
  3. Warning Displays
  4. Performance Standards
  5. Rider Trust

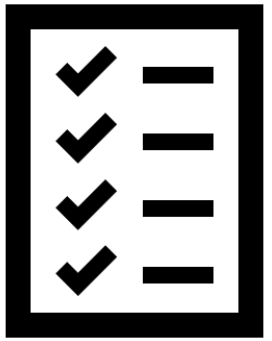
Agency Listening Session

- **Equipped Vehicle and Driver Detection of Motorcycles and Accuracy**
  - Assess current machine vision systems



- **Performance Standards**
  - Include and consider motorcycle safety and AV/CAV interaction

- **Rider Trust**
  - Decision Making



Motorcyclist Focus Group

- Two 90-minute focus groups were conducted with a total of 16 participants

- Participant Overview
  - 88% of all participants identified as male
  - Median Age 55+ years

- Experience
  - All participants had a minimum of 6 years of riding experience
  - 81% of all participants had over 10 years riding experience
  - 56% considered themselves to ride regularly
  - Half of the pool considered identified as a motorcycle instructor or educator

Motorcyclist Focus Group: Identified Benefits

- **System Reaction Times**
  - Increased visibility
  - Improved reaction time
- **Improve Novice Rider Confidence**
  - Increase and improve practice
  - Turn on/off safety features
- **Preventative Safety Measure**
  - Unforeseen safety scenarios

Motorcyclist Focus Group: Identified Concerns

- **Overreliance on Technology**
  - Hinder situational awareness skills
  - Tech can malfunction
- **Warning Display Distraction**
  - Nuisance alarms
- **Rider Interaction**
  - Not respond well to autonomous features
- **User Acceptance**
  - Community will not accept

Future Work in ITS for Motorcycles

- Areas of Future Research

1. Rider Acceptance
2. Warning Intervention Displays, Modes, and Timing

- Other Future Research Areas
  - Motorcycle VMT Uncertainty and Data
  - Sight Distance
  - Pavement Condition(s)
  - Construction Zones and Maintenance
  - Lane Splitting and Filtering
  - Level and Type of Pavement Deterioration
  - Effect of Surface Condition

Q&A