



Automated Driving Systems Research Update

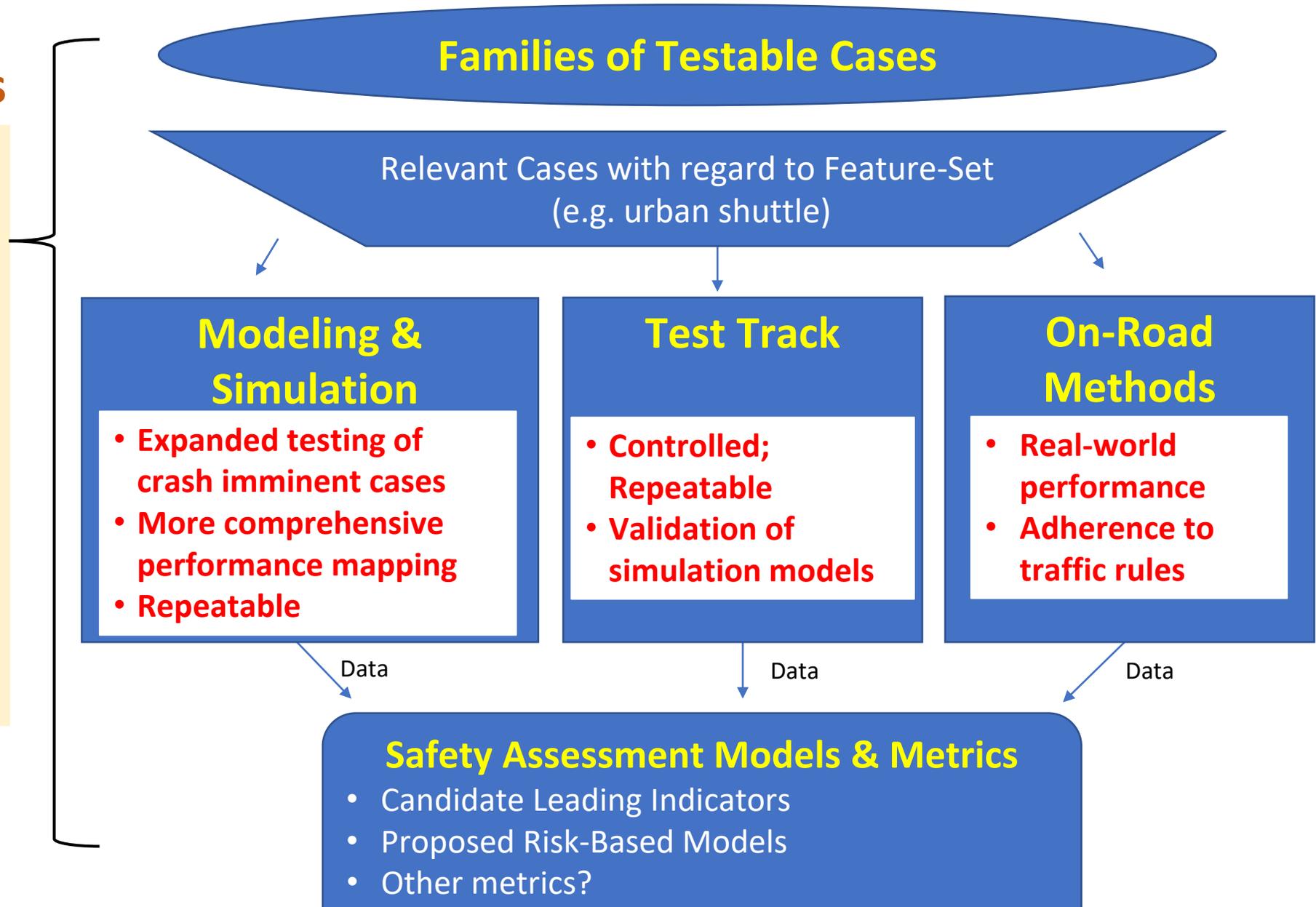
*SAE Government Industry Meeting
Robert Kreeb*

January 2022

ADS Research Areas

- **System Safety Performance**
- **Sub-system Testing & Functional Safety**
- Human Factors
- Crashworthiness

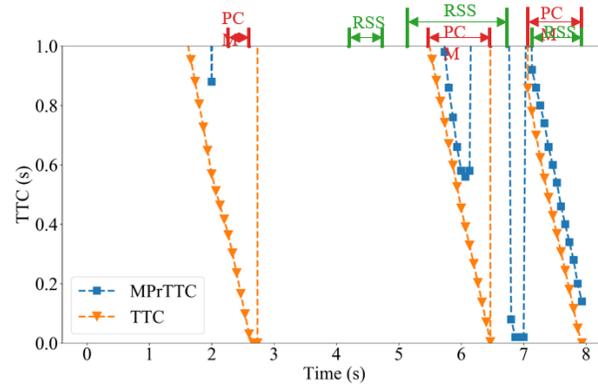
- Cybersecurity, Resiliency, Best Practices, ...



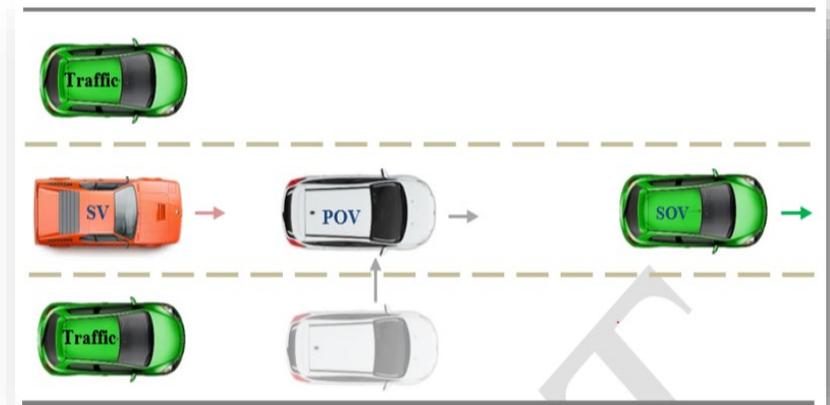
Sample of NHTSA ADS Safety Research Projects



On-road Ground Truth Trip Recorder



Metric Evaluations



Testable Cases



Simulation



Complex Test Track Execution

Upcoming ADS
Research

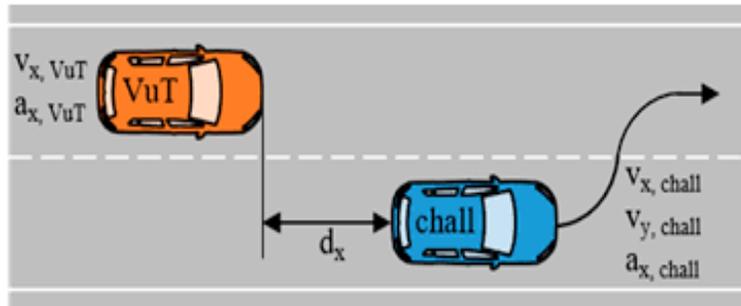
On-Road Safety Assessment Methods

Ground
Truth Trip
Recorder
(GTTR)



- Relatively easy install, no damage to vehicle
- 17 remote sensors, HD map, 360 degree coverage
- Simple pre-trip calibration
- Unscripted on road driving for data collection

Data
Collection &
Processing



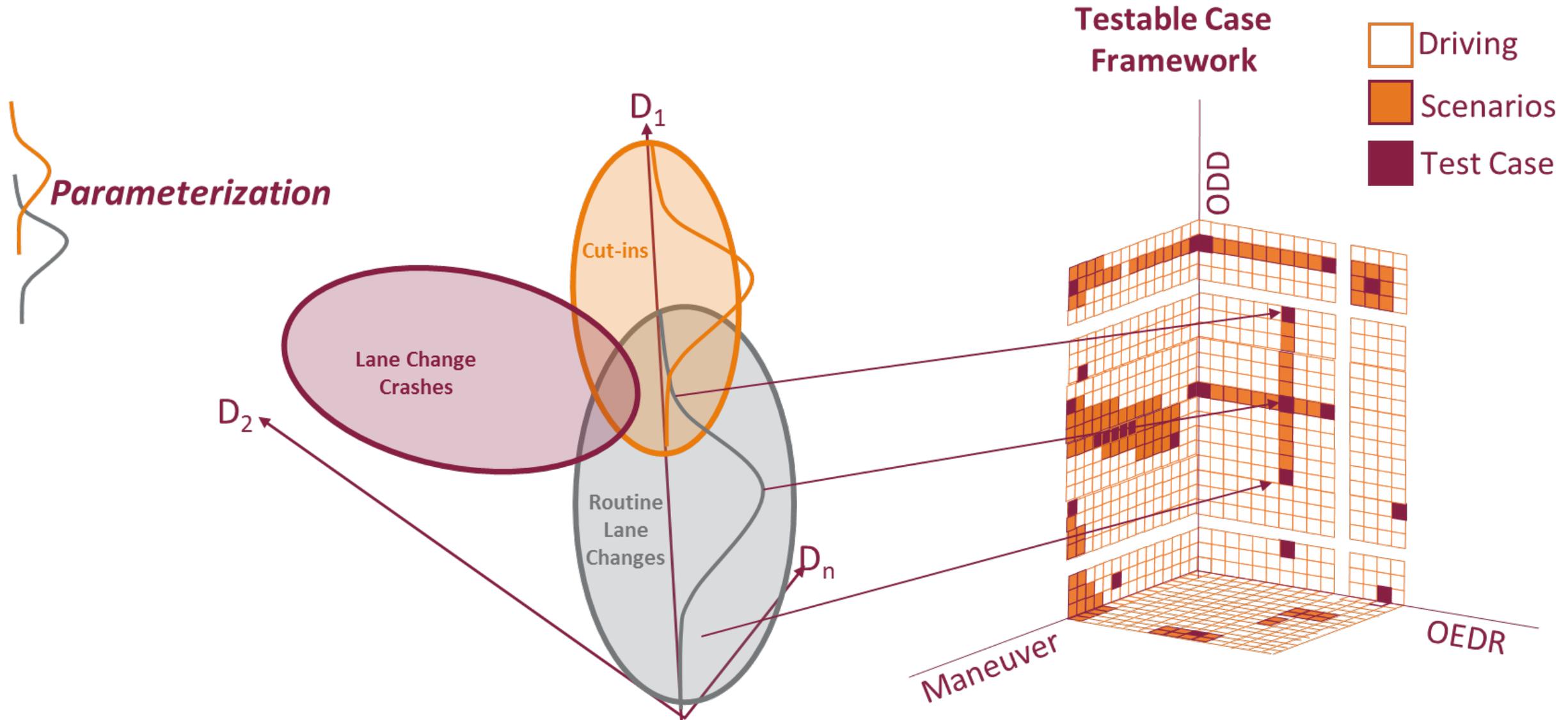
- Onboard recording & timestamping
- Post-processing for object fusion and tracking
- Targeted scenario identification
- Kinematic and competency metrics

Metrics Assessment

- The vehicle will be marked as all red when the metric threshold is exceeded.

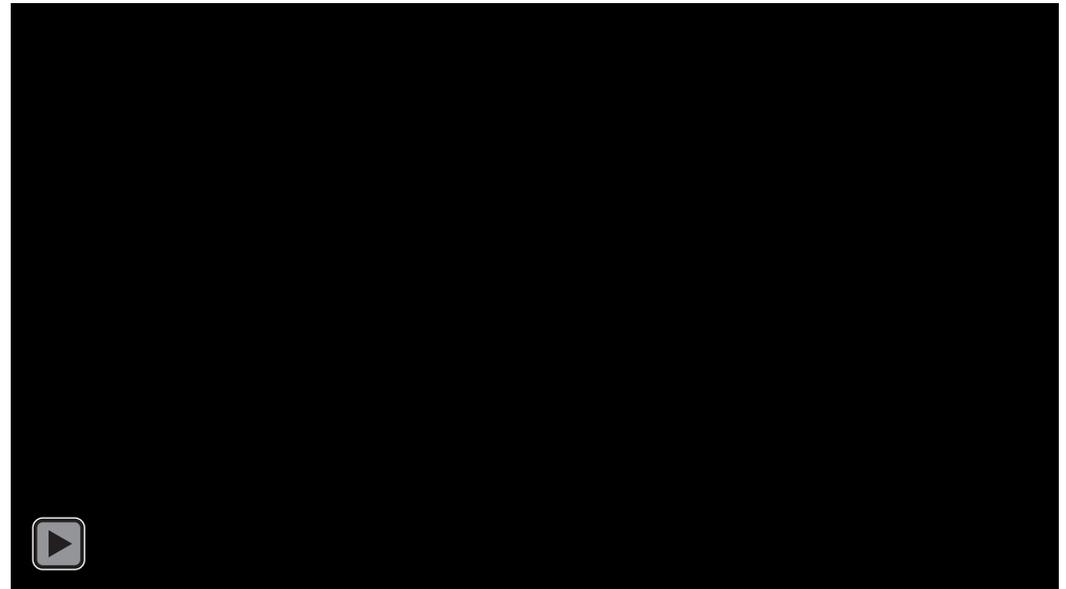
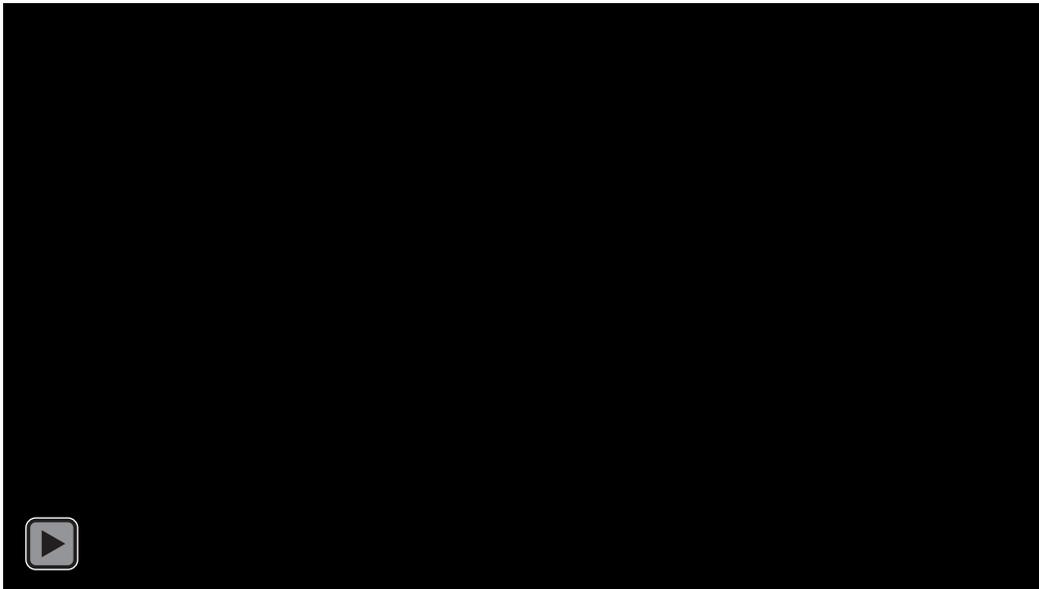
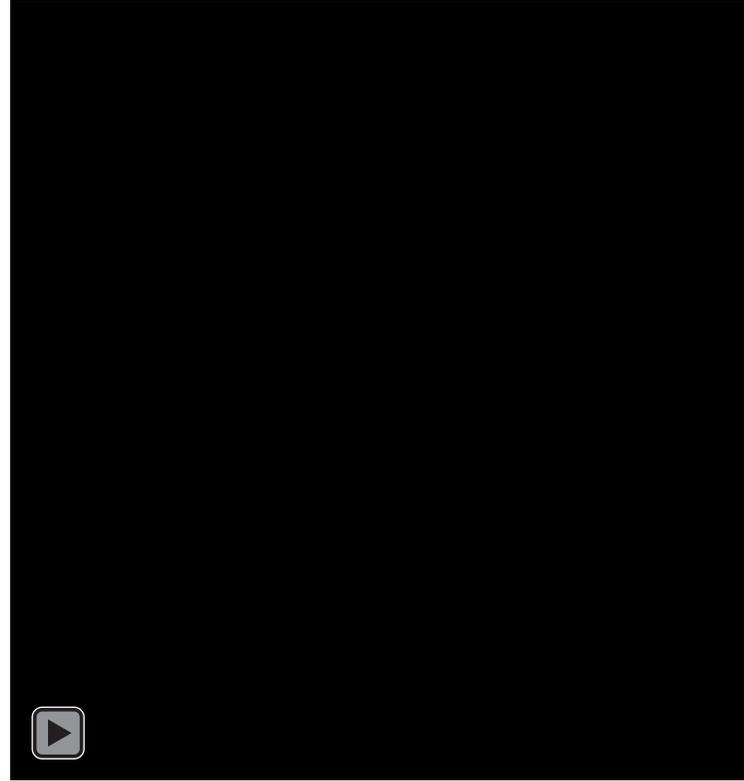


Methods for identifying Testable Cases..





Simulation Studies



Test Track Research

- Will use a production vehicle equipped with open-source software, controllers, and sensors to help enable applied research in this area



- Autoware open-source system
- Drive-by-wire system
- Sensors
 - Radar
 - Lidar
 - Cameras
 - GNSS

- Enable test track methodology research with selected driving applications
- Enable research on simulation-to-test track driving scenario validation methods

Upcoming ADS Research

Recent ADS Research Project Starts

Project Title	Project Title
Performance Assessment of ADS Perception Systems	Safety Assessment of Heavy Truck ECBS and Electronic Steering Systems
Performance Assessment of ADS Control Systems	On-Road Driving Performance Evaluation of ADS Heavy Trucks
ADS Durability and Preventive Maintenance	Simulation Use and Best-Practices for ADS Development
Operational Safety Responsibilities of L4 ADS MaaS Fleet Operators	Use of Artificial Intelligence (AI) / Machine Learning (ML) Techniques in Driving Automation Technologies

Thank you for your time and attention

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