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

Families of Testable Cases

Relevant Cases with regard to Feature-Set (e.g. urban shuttle)

Modeling & Simulation
- Expanded testing of crash imminent cases
- More comprehensive performance mapping
- Repeatable

Test Track
- Controlled; Repeatable
- Validation of simulation models

On-Road Methods
- Real-world performance
- Adherence to traffic rules

Data

Safety Assessment Models & Metrics
- Candidate Leading Indicators
- Proposed Risk-Based Models
- Other metrics?

- Cybersecurity, Resiliency, Best Practices, ...
Sample of NHTSA ADS Safety Research Projects

On-road Ground Truth Trip Recorder

Metric Evaluations

Testable Cases

Upcoming ADS Research

Simulation

Complex Test Track Execution
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

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Assessment of ADS Perception Systems</td>
<td>Safety Assessment of Heavy Truck ECBS and Electronic Steering Systems</td>
</tr>
<tr>
<td>Performance Assessment of ADS Control Systems</td>
<td>On-Road Driving Performance Evaluation of ADS Heavy Trucks</td>
</tr>
<tr>
<td>ADS Durability and Preventive Maintenance</td>
<td>Simulation Use and Best-Practices for ADS Development</td>
</tr>
<tr>
<td>Operational Safety Responsibilities of L4 ADS MaaS Fleet Operators</td>
<td>Use of Artificial Intelligence (AI) / Machine Learning (ML) Techniques in Driving Automation Technologies</td>
</tr>
</tbody>
</table>
Thank you for your time and attention

Robert Kreeb
Chief, Electronic Systems Safety Division
Office of Vehicle Safety Research
NHTSA
robert.kreeb@dot.gov