NHTSA’s FMVSS Considerations for Vehicles with Automated Driving Systems

SAE Government/Industry Meeting
04.03.2019
OVERVIEW

- Policy (3.0, 2.0)
- Research
- Regulatory Efforts
Preparing for the Future of Transportation (AV 3.0)

- Released October 2018
- New multimodal safety guidance
- Clarifies policy and roles
- Outlines how to work with U.S. DOT as automation technology evolves
A Vision for Safety (AV 2.0)

- Voluntary guidance on design, testing, and safe deployment of ADS remains central to U.S. DOT’s Approach.
- Released September 2017.
- Encourages companies to consider and document their approach to 12 safety elements.

1. Vehicle Cybersecurity
2. System Safety
3. Operational Design Domain
4. Object and Event Detection and Response
5. Fallback (Minimal Risk Condition)
6. Validation Methods
7. Human Machine Interface
8. Crashworthiness
9. Post-Crash ADS Behavior
10. Data Recording
11. Consumer Education and Training
12. Federal, State, and Local Laws
RESEARCH

1. Removing Regulatory Barriers

2. ADS System Safety Performance; Functional Safety; Cybersecurity

3. Human Factors

4. Crashworthiness Occupant Protection
Removing Regulatory Barriers

Background: Review of Federal Motor Vehicle Safety Standards (FMVSS) for Automated Vehicles

- Preliminary Report, March 2016
  
  https://rosap.ntl.bts.gov/view/dot/12260

- Volpe National Transportation Systems Center
  - Identify instances where existing FMVSS may pose challenges to the introduction of automated vehicles.

Research Objectives

- Driver scan for explicit or implicit reference to a human driver.
- Automated vehicle concept scan to identify challenges for a wide range of automated vehicle capabilities and concepts.
Removing Regulatory Barriers

FMVSS Considerations for Vehicles with Automated Driving Systems

- Multi-year project, initiated in September 2017
- Virginia Tech Transportation Institute (VTTI)
- Research Objectives:
  - Provide technical translation options of FMVSS and related compliance test procedures for ADS-equipped vehicles.
  - Identify any regulatory barriers to self-certification and compliance verification of innovative new vehicle designs with ADS.
Phase 1

- **30 FMVSS**
- **Focus:** ADS-DVs without manual controls.

**Approach**

- Code the translation category.
- Detailed analysis of regulatory text & compliance test procedures.
- Engage subject matter experts for review.
FMVSS Considerations for Vehicles with Automated Driving Systems - VTTI

Core Team

Myra Blanco, Ph.D.
PI & Program Manager

Michelle Chaka, M.S.
CFO & Crash Avoidance Lead

Warren Hardy, Ph.D.
Co-PI & Crashworthiness Lead

VTTI's FMVSS Expert Group

William Hollowell, Ph.D.
Joseph Kananthra, Ph.D.
Stephen W. Rouhana, Ph.D.
George Soodoo, M.B.A.
Kenneth Weinstein, J.D.

Research Team Members

Industry Group

GM
Nissan

Research Institutions

Booz Allen Hamilton

Test Facilities

DRI
SwRI

Stakeholder/SME Reviewer Group

Advocates for Highway and Auto Safety
Apple
Auto Alliance for Driving Innovation
Automotive Safety Council
Bosch
Calspan
Center for Auto Safety
Continental
Daimler
DAIMLER
Insurance Institute for Highway Safety
EMA
EPA
FCA
Global Automakers
GM
Tesla
NIO
Peloton

SAE
Test & Research Technical Research
Volkswagen
Waymo
Zoox
FMVSS Considerations for Vehicles with Automated Driving Systems - VTTI

Crashworthiness Challenges (FMVSS 200-series)

- FMVSS use of the terms: *driver, driver’s seat, driver’s designated seating position*, and similar terms.
- FMVSS primarily aimed at driver/front row protection.

Crash Avoidance Challenges (FMVSS 100-series)

- FMVSS use of a “human” driver using manually-operated driving controls (steering wheel, brakes, etc.).
- FMVSS that specify the “manner in which a vehicle is controlled” required careful review and consistent translation approach.
### FMVSS Considerations for Vehicles with Automated Driving Systems - VTTI

Crash Avoidance Challenges (FMVSS 100-Series)

- Cross-walk on functionality categories for physical test execution:

<table>
<thead>
<tr>
<th>Category</th>
<th>Functionality</th>
<th>102</th>
<th>108</th>
<th>114</th>
<th>118</th>
<th>138</th>
<th>141</th>
<th>101</th>
<th>103</th>
<th>104</th>
<th>110</th>
<th>111</th>
<th>113</th>
<th>124</th>
<th>125</th>
<th>126</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Driving Tasks</strong></td>
<td>Steering control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Speed control (vehicle/engine)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Service brake application</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parking brake</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gear selection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vehicle Communications</strong></td>
<td>Telltales/warnings/indicators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Key/Ignition Function</strong></td>
<td>Key insertion/removal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ignition start/stop</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accessory mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Non-driving Tasks</strong></td>
<td>Door open/close</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-driving controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Environment Awareness</strong></td>
<td>Visibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


FMVSS Considerations for Vehicles with Automated Driving Systems - VTTI

Crash Avoidance Challenges (FMVSS 100-Series)

Evaluation of Test Procedure Methods
FMVSS Considerations for Vehicles with Automated Driving Systems – VTTI

Stakeholder Meetings:
April 2018 & November 2018
FMVSS Considerations for Vehicles with Automated Driving Systems - VTTI

Examples of Cross-cutting Themes in FMVSS

- Use of driver (operator); driver/passenger presence
- Equipment may not be applicable
- Controls, telltales, indicators, and auditory alerts

Analysis of Information Communicated in Vehicles

<table>
<thead>
<tr>
<th>Categories</th>
<th>Analysis Questions</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Communicated</td>
<td>What is communicated? What type of communication?</td>
<td>Engaged, warning, malfunction, identification</td>
</tr>
<tr>
<td>Delivery Method</td>
<td>How is information delivered?</td>
<td>Illumination of a telltale, auditory alert, indicator</td>
</tr>
<tr>
<td>Intended For</td>
<td>Whom is the information for?</td>
<td>Driver, non-driving occupants, maintenance entity</td>
</tr>
<tr>
<td>Expected Response</td>
<td>What action is expected in response to information?</td>
<td>After a low tire pressure warning is activated, someone is expected to check the tire(s) and take appropriate action</td>
</tr>
</tbody>
</table>
FMVSS Considerations for Vehicles with Automated Driving Systems - VTTI

Next Steps

- Near–term Completion of Volume 1 Report (12 FMVSS)
- Draft Volume 2 Report (18 FMVSS)

Ellen Lee
NHTSA COR (TO)
E-mail: ellen.lee@dot.gov
Phone: 202-366-1435

Myra Blanco
VTTI PI/Project Manager
E-mail: mblanco@vtti.vt.edu
Phone: 540-231-1551
Regulatory Efforts

Pilot Program ANPRM
Notices of Receipt – Petitions for Temporary Exemption
Regulatory Efforts

Pilot Program for Collaborative Research on Motor Vehicles with High or Full Driving Automation

- Advance Notice of Proposed Rulemaking (ANPRM)
  - Published 10.10.18
  - Seeks public comment related to the near-term & long-term challenges of ADS testing, development & eventual deployment.
    - Potential factors to be considered in designing a pilot program;
    - Use of existing statutory provisions and regulations;
    - Additional elements of regulatory relief; and
    - Exemption petition evaluation.

Regulatory Efforts

Petitions for Temporary Exemptions

■ 49 Code of Federal Regulations Part 555 Final Rule
  • Published 12.26.18; Regulations.gov: Docket No. NHTSA-2018-0103.
  • Aims to streamline the application & review process for petitions submitted by manufacturers while continuing to prioritize safety for drivers, occupants, and other road users.

■ Notices of Receipt - Temporary Exemption Petitions
  • Published 03.19.19
  • General Motors, LLC (Zero-Emission Autonomous Vehicle or ZEAV)
  • Nuro, Inc. (R2X)
Thank you for your attention.

Contact Information:

Lori Summers, NHTSA
Email: lori.summers@dot.gov