FMVSS Considerations for Vehicles With Automated Driving Systems: Project Update

NHTSA | VT TRANSPORTATION INSTITUTE VIRGINIA TECH

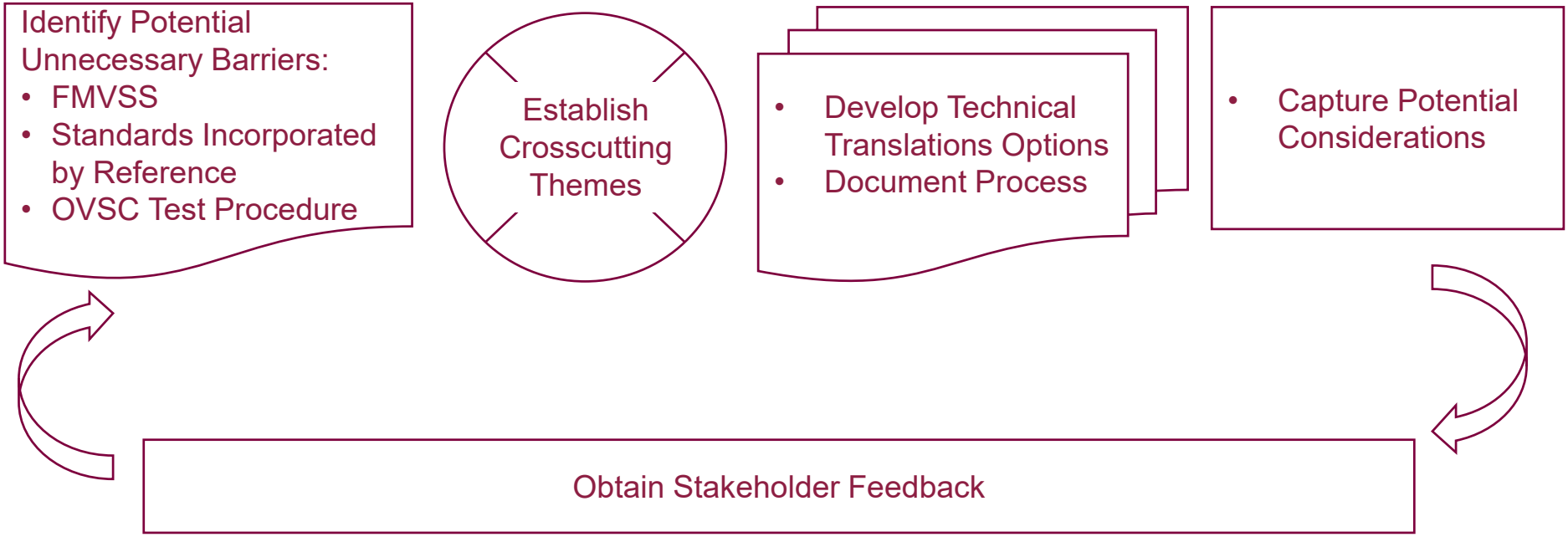
FMVSS Considerations for Vehicles with ADSs

Project Overview:

- NHTSA-sponsored, multi-year project initiated in September 2017
- Identify unnecessary/unintended regulatory barriers to self-certification and compliance verification of innovative vehicle designs with Automated Driving Systems (ADSs)
- Provide technical translation options of FMVSS and related compliance test procedures for ADS-equipped vehicles
- Focus is on ADS-Dedicated Vehicles (ADS-DVs) that lack manually operated driving controls (e.g., steering wheel, brake pedal)

FMVSS: Federal Motor Vehicle Safety Standards

Technical Translation Approach

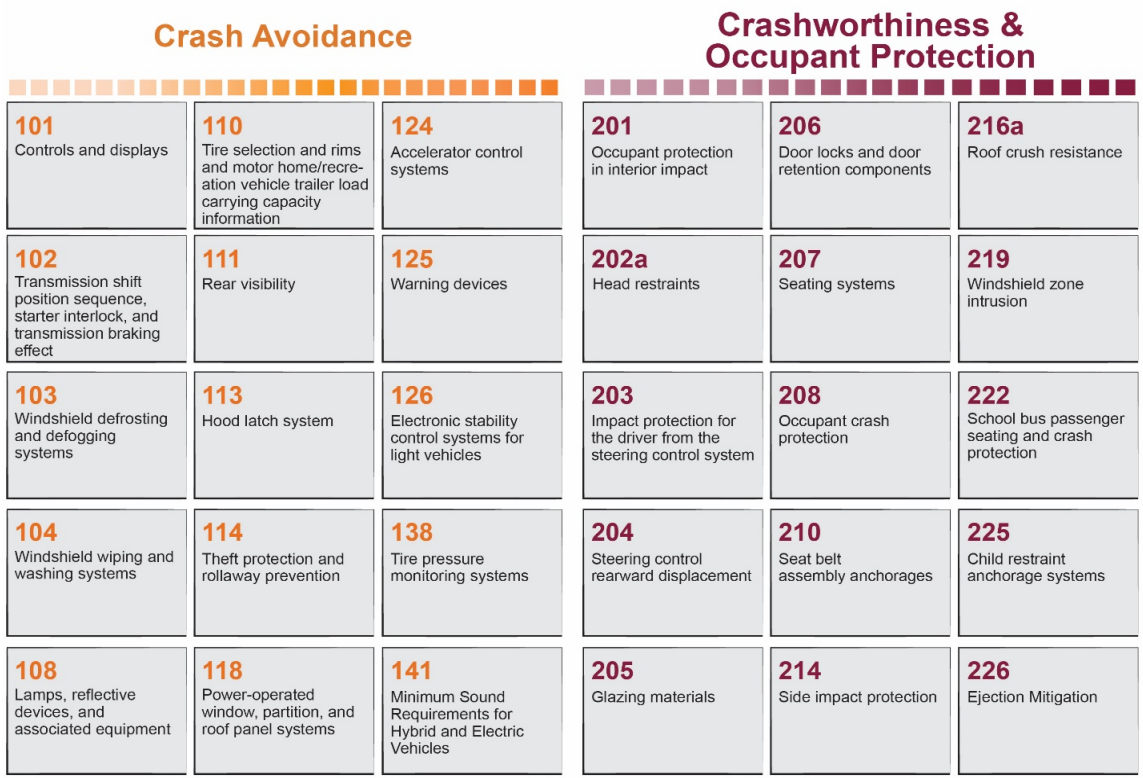


OVSC: Office of Vehicle Safety Compliance

FMVSS Covered in Volume 1 and 2 Research

Focus Areas:

- Address the fundamental crosscutting assumptions (e.g., driver and seating position, service brake application, gear position/selection, and telltales)
- Apply passenger seating position test procedures to the left front outboard seating position (200-series)
- Develop considerations for addressing bidirectional vehicles (100-series)
- Focus on test method development (100-series)

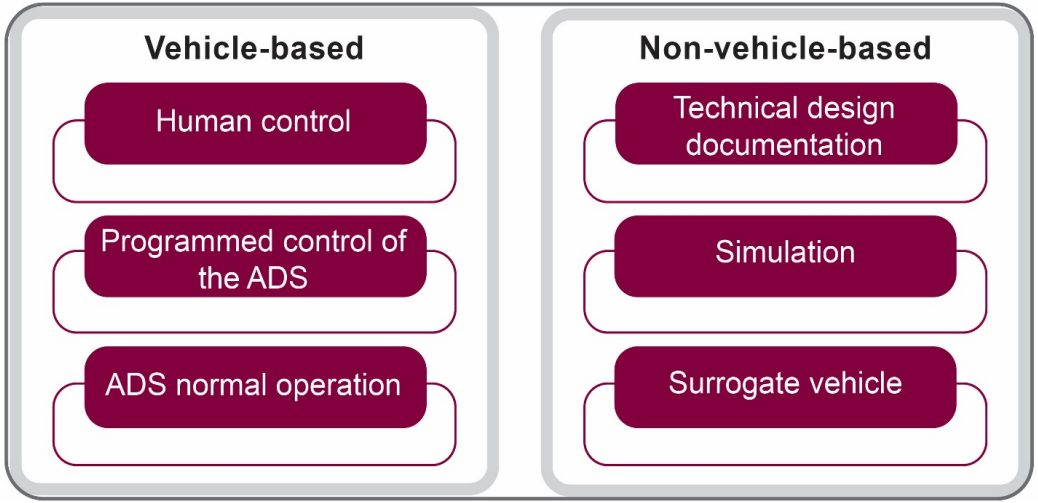


Crash Avoidance Test Methods and Evaluation: Volume 1 and 2

Volumes 1 and 2 explored a range of potential compliance verification test methods for ADS-DVs

Research testing was completed for:

- FMVSS No. 114: Theft Protection and Rollaway Prevention
- FMVSS No. 138: Tire Pressure Monitoring Systems
- FMVSS No. 126: Electronic Stability Control Systems (ESC) for Light Vehicles

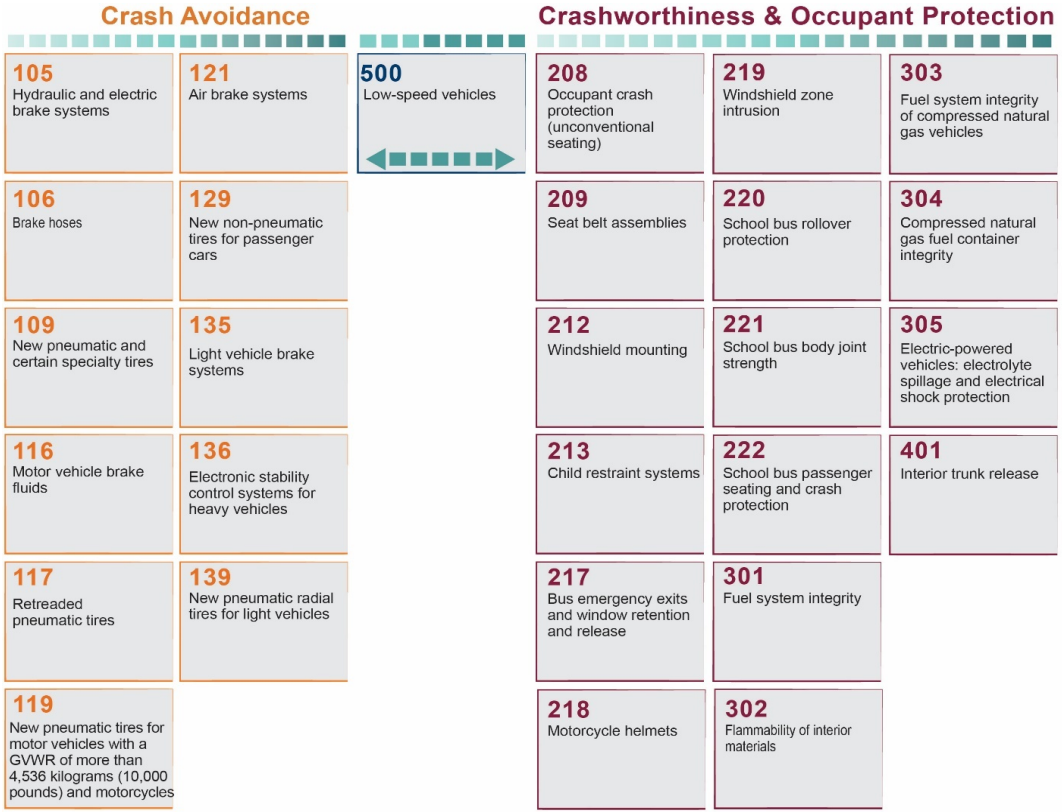


Test Method Considerations

FMVSS Covered in Volume 3

Focus Areas:

- Braking and heavy truck electronic stability control (ESC) standards
- Low-speed vehicles standard
- 300-series standards (post-crash)
- Unconventional seating considerations for occupant crash protection (FMVSS No. 208)



*See Notice of Proposed Rulemaking, "Occupant Protection for Automated Driving Systems," 85 Fed. Reg. 17624, 17634, 17634 n.53 (March 30, 2020)

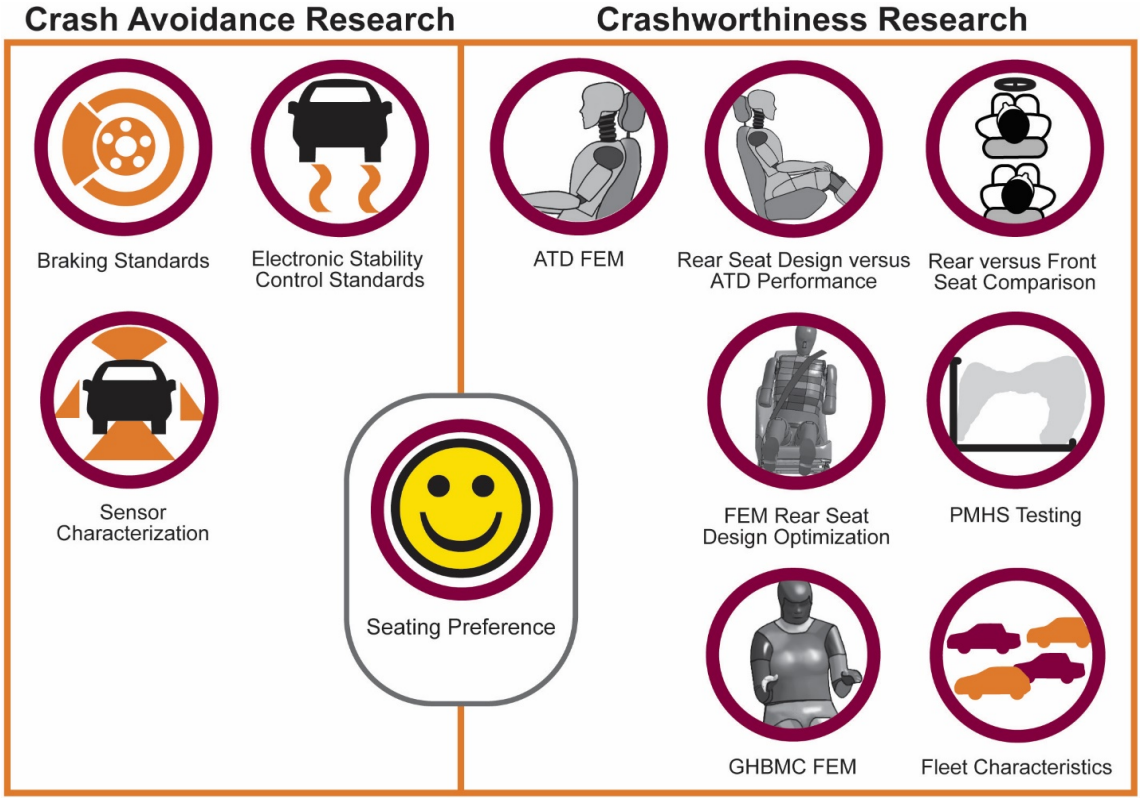
Unconventional Seating Technical Translation Scope: Volume 3

Stationary face-to-face designated seating positions were selected for initial technical translation of FMVSS No. 208 analysis:

- Maximizes use of conventional restraint systems
- Aligns with current research initiatives
- Offers the least amount of complexity

Unconventional Seating Illustration

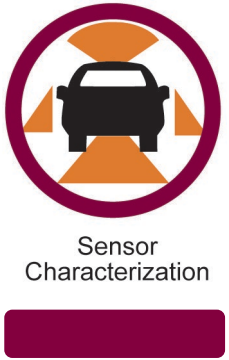
Beyond Volume 3: Ongoing Research



Braking and ESC Standards

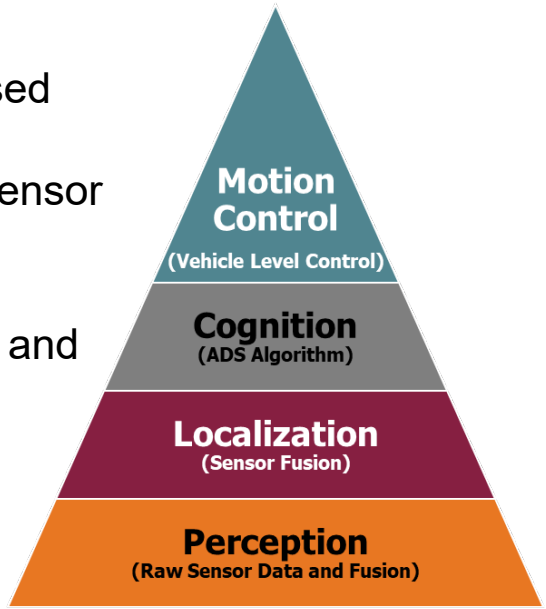
- Conduct FMVSS No. 135 evaluation of human (surrogate) and programmed control test methods and identify unique considerations:
  - Test requirements that may not be applicable to an ADS or may be outside the way the vehicle is designed to operate
  - What the ADS can't do and why not
- Evaluate alternate steering control inputs (e.g., road wheel angle) for test execution identified in FMVSS No. 126 Volume 2 technical translation options
- Assess implementation suitability of findings from FMVSS Nos. 135 and 126 for heavy vehicles (FMVSS Nos. 121 and 136)

Sensor Characterization



Explore sensor capabilities and evaluate and characterize critical sensor attributes by:

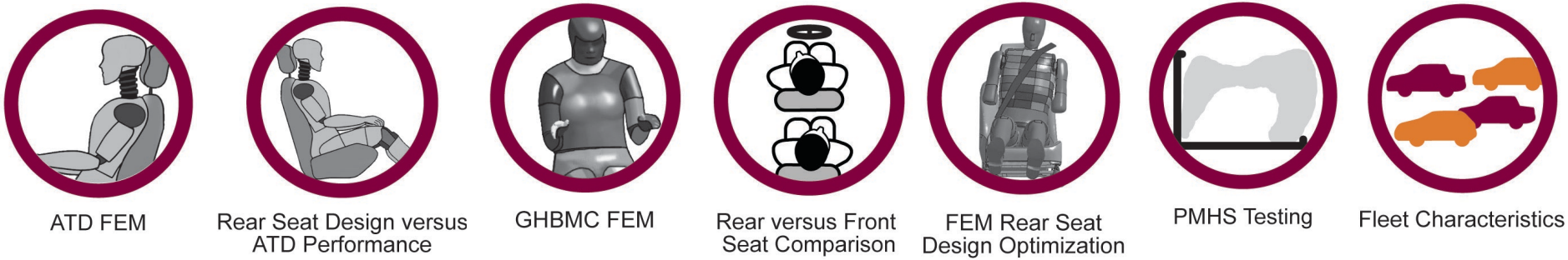
1) Surveying test procedures and measures used by industry
2) Identifying potential gaps in characterizing sensor performance
3) Measuring sensor performance
4) Evaluating methods to characterize nominal and degraded sensor performance for ADS applications



ADS Control Architecture

Occupant Protection and Crashworthiness

- Front seat bias was found to be a key consideration during the review of FMVSS No. 208 in Volume 2
- Research was initiated to explore the potential issues for future translations of crashworthiness regulations for occupants seated anywhere other than in the front row of an ADS-DV
- There are seven related areas that examine the expected incidence and outcomes of rear-seated occupants in an ADS-DV with conventional (forward-facing) seats including:
  - Developing dummy positioning procedures for rear-seated ATDs
  - Assessing candidate injury criteria for rear-seated occupants (PMHS testing)
  - Evaluating ATD performance for rear-seated occupants (sled testing and GHBMC FEM)



ATD: anthropomorphic test device
PMHS: Post-mortem Human Subjects
FEM: finite element modeling
GHBMC: Global Human Body Models Consortium

Seat Preference

Explore occupants' **preferred seating** positions in an ADS-DV

Examine the prevalence of **seat belt use** in an ADS-DV

Consider how FMVSS **information** could be **communicated to occupants** and study if the information is understood

Seating Preference

Thank You

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- **Volume 1 Publication:** https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/ads-dv_fmvss_vol1-042320-v8-tag.pdf

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