NHTSA’s ESC Research Program: 2005/06 Activities

March 1, 2006

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Presentation Overview

- 2005 Testing
- Maneuver Reduction
- ESC Evaluation Metrics
- Repeatability Evaluation
- Future Research
- Concluding Remarks
2005 Testing

- **ESC Effectiveness**
  - Participated in a collaborative data collection with 11 vehicle manufacturers
  - 62 vehicles, 128 configurations evaluated
  - Thank you for your participation!

- **Sine with Dwell Repeatability**
  - Collaborative testing effort with the Alliance of Automobile Manufacturers
  - Two vehicles presently being evaluated at five proving grounds
0.7 Hz Sine with Dwell

- Requires use of a steering machine
- Based on a single cycle sinusoidal steering input
- Frequency is 0.7 Hz
- 500 ms pause after 3rd quarter cycle
- Performed at 50 mph (drop throttle only)
- Severity increased via steering angle increments
ESC Evaluation Metrics

- Many methods for evaluating lateral stability and responsiveness considered

- Lateral stability:
  - Vehicle must not spinout (oversteer mitigation)
  - Requires yaw rate to decay in a reasonable manner

- Responsiveness:
  - Complements lateral stability
  - Reflects NHTSA opinion that it is important for a vehicle retain reasonable avoidance capability
Repeatability Evaluation

- The outcome of a test used to evaluate minimum performance should not depend on where the test was performed.
- Tests being performed at five locations:
  - Ohio (VRTC)
  - Michigan
  - South Carolina (VRTC)
  - Arizona
  - California
Documentation/Presentation

- **Documentation**
  - ESV Paper 05-0221 *(Phase 1 research)*
  - DOT HS 809 875 *(human driver steering capability)*
  - Technical report summarizing 2005 ESC research in approval circulation

- **Presentations**
  - 2005 ESV
  - 2005 SAE Government / Industry
  - ESC docket 19951
Research Objectives

- Determine common understeer events
- Identify a test maneuver(s) capable of quantifying understeer mitigation effectiveness
- Assess low friction test feasibility
2006 Research
Understeer Mitigation

- Anticipated maneuvers
  - J-Turn
  - Closing Radius Turn
  - Slowly Increasing Steer

- Small, diverse test fleet
  - Sports car
  - Two SUVs
  - Two sedans
  - 15-passenger van

- One load configuration (Nominal load)

- Testing to begin spring 2006
ESC benefits on low friction surfaces have been documented, but are based on crash data and subjective test track evaluations.

Results from tests performed on low friction surfaces are prone to high test variability.

NHTSA would like to objectively quantify the effects of understeer mitigation so that minimum performance criteria can be developed.

NHTSA would greatly appreciate suggestions on how to resolve this problem!
2006 Research
Roll Stability Control (RSC)

- **Research Objectives**
  - Gain an increased awareness of RSC functionality and effectiveness
  - Determine metrics capable of identifying whether a vehicle is equipped with RSC
  - Assess whether improved dynamic rollover resistance is achieved at the expense of lateral stability and/or responsiveness

- **Results will be documented in a technical report**
2006 Research
Roll Stability Control (RSC)

- Maneuvers to evaluate rollover, lateral stability, and responsiveness
  - NHTSA Fishhook
  - 0.7 Hz Sine with Dwell
- Four SUVs
- Four load configurations *(presented on next slide)*
- Testing to begin early spring of ’06 at VRTC
2006 Research
Anticipated RSC Load Configurations

- **Nominal Load**
  - Instrumentation, driver, and outriggers

- **Multi-Passenger Load**
  - Three 175 lb water dummies

- **Rear Trunk Load**
  - Vehicle weight at GVWR, rear GAWR

- **Roof Load**
  - Ballast to maximum recommended by manufacturer
  - SSF lowered by 0.1
Concluding Remarks

- NHTSA has identified the 0.7 Hz Sine with Dwell as a good maneuver for evaluating the lateral stability and responsiveness of ESC-equipped vehicles.
- Future testing will include the evaluation of understeer mitigation and RSC.
- Any suggestions on how to best evaluate these technologies would be appreciated!
Questions?