



NHTSA's ESC Research Program: 2005/06 Activities

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Presentation Overview

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



2005 Testing

- **ESC Effectiveness**

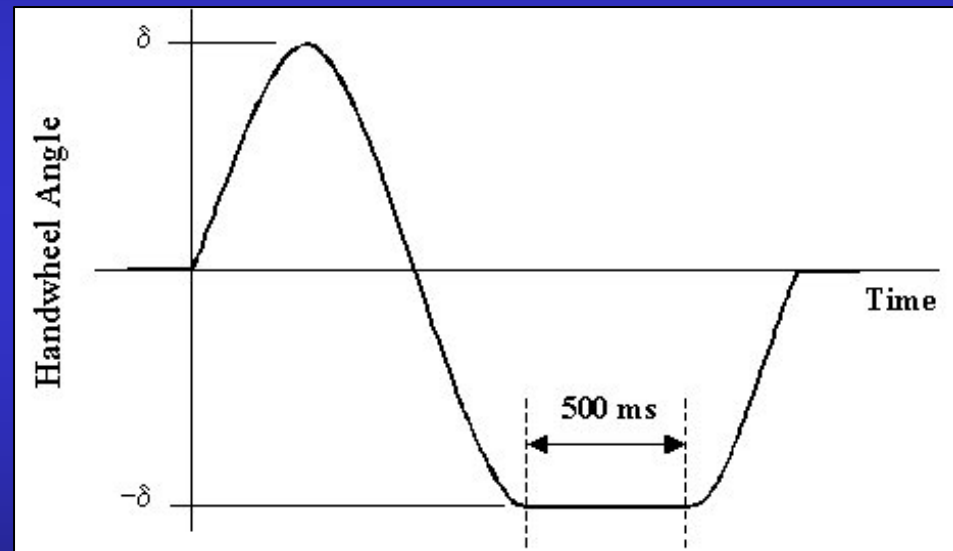
- Participated in a collaborative data collection with 11 vehicle manufacturers
- 62 vehicles, 128 configurations evaluated
- Thank you for your participation!

- **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**

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

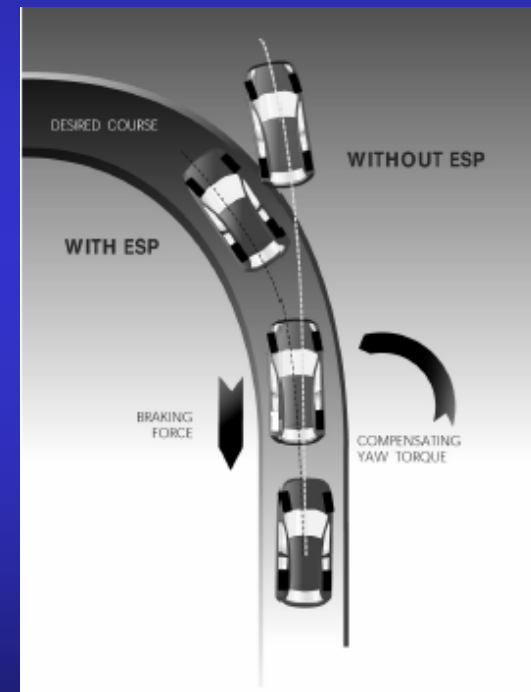
- **Presentations**

- 2005 ESV
- 2005 SAE Government / Industry
- ESC docket 19951

2006 Research Understeer Mitigation

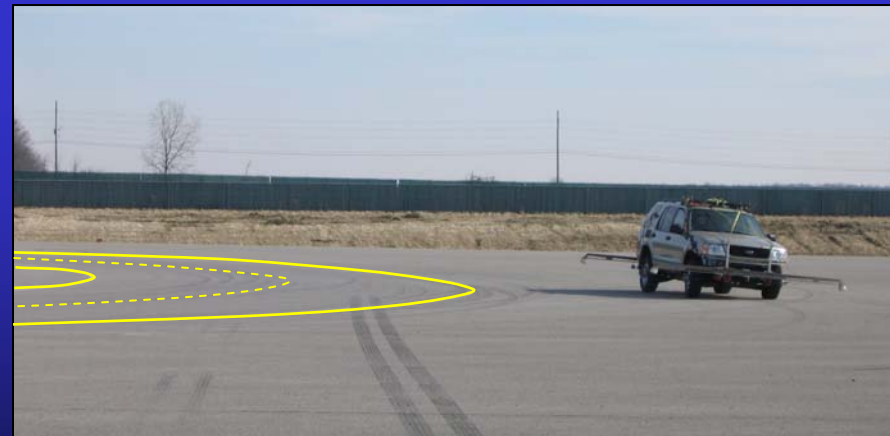
Research Objectives

- 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**



2006 Research

Understeer Mitigation – Testing Concerns

- 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?