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An Overview of NHTSA's 2006 Light Vehicle ESC Research Program

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Presentation Overview

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- 2005 ESC Testing
- Understeer Mitigation Research
- RSC Research
- Concluding Remarks

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2005 ESC Testing

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- **Work focused on developing a way to evaluate ESC performance**
  - Focus was on lateral stability and responsiveness
  - Test maneuver selection
  - Creation of minimum performance criteria
- **Data collection was a collaborative effort**
  - NHTSA and 11 vehicle manufacturers
  - Over 62 vehicles and 128 configurations were tested
- **Technical report to be released in 2006**

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ESC Understeer Mitigation Research at VRTC

2006 Understeer Mitigation Research Objectives

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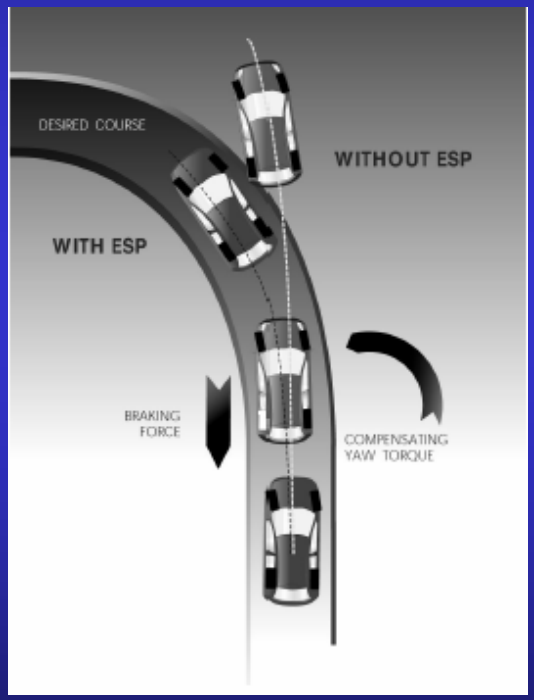
- **Examine situations where excessive understeer may occur**
- **Identify a test maneuver(s) capable of quantifying understeer mitigation effectiveness**
- **Assess low friction test feasibility**



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Real World Situations Where Excessive Understeer May Occur

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Example: Decreasing Radius Curves

I-79 to I-70 Ramp in Washington, PA

Interchange 12 in Carteret, NJ

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2006 Understeer Mitigation Research Test Program

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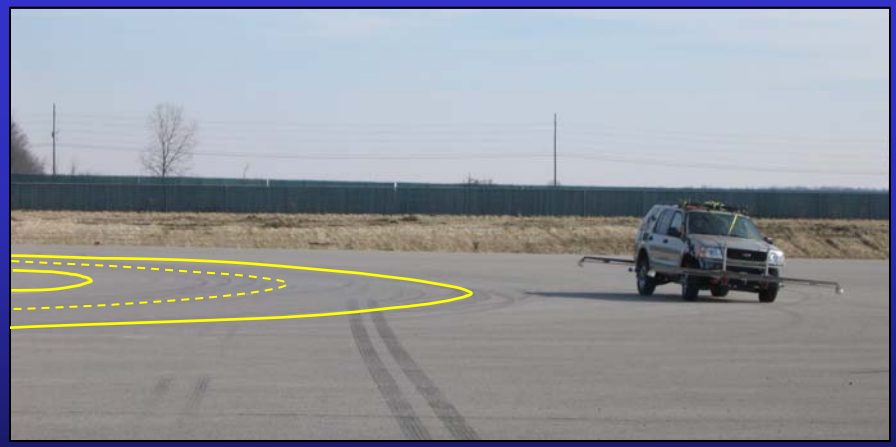
- **Anticipated maneuvers**
  - **J-Turn**
  - **Closing Radius Turn**
  - **Slowly Increasing Steer**
- **Small, diverse test fleet**
  - **Sports car**
  - **Two SUVs**
  - **Two sedans**
  - **15-passenger van**

- **One load configuration** *(Nominal load)*
- **Testing initiated April 2006**



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2006 Understeer Mitigation Research Testing Concerns

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- **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**
- **Suggestions on how to resolve this problem would be greatly appreciated!**

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Roll Stability Control (RSC) Research at VRTC

What is RSC?

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- In this presentation, "RSC" is a generic term for roll stability control
  - Note: The terms Roll Stability Control and RSC are trademarks of the Ford Motor Company
- RSC control logic is only available on vehicles equipped with ESC
- Unlike those associated with conventional ESC, RSC interventions are specifically intended to lessen body roll angle via a reduction in the lateral forces produced by the tires

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How does RSC work?

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- Braking introduces longitudinal wheel slip
- As this slip increases, the lateral force capability of the vehicle's tires is significantly reduced
- The reduced lateral force capability results in reduced lateral acceleration
- In an RSC intervention, significant braking occurs at the outside front corner of the vehicle

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Intervention Example
Ford Explorer and Lincoln Navigator

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Note RF wheel lock

Note effect on path

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Effect of RSC Intervention

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- **Since the primary objective of RSC intervention is on-road rollover mitigation, a brief loss of path-following capability is deemed acceptable**
  - **Vehicle dependent effect**
  - **NHTSA's responsiveness metric is one (albeit limited) way of objectively quantifying this effect**
- **Effect is being / will be researched**
- **Controllability of little practical use if vehicle is on two wheels!**

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Intervention Example
2005 Mitsubishi Montero

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Note intervention effectiveness, entrance speed differences

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2006 RSC Research
Objectives

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- Develop an increased understanding of RSC functionality
- Assess how loading can influence RSC effectiveness
- Develop a way 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

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2006 RSC Research
Test Program

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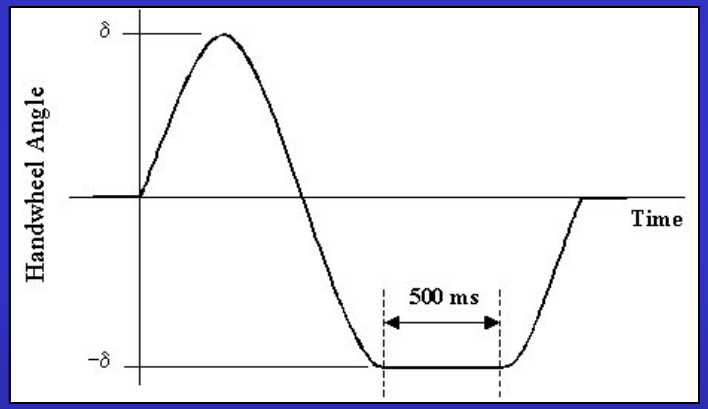
- **Maneuvers**
  - NHTSA Fishhook
  - 0.7 Hz Sine with Dwell
- **Four SUVs**
  - 2006 Jeep Grand Cherokee
  - 2005 Ford Explorer
  - 2005 Mitsubishi Montero
  - 2005 Nissan Armada
- **Four load configurations**

Sine with Dwell Maneuver



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2006 RSC Research
Anticipated Load Configurations

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- **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

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Concluding Remarks

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- **A technical report summarizing the 2005 ESC tests is presently being circulated for approval**
- **2006 RSC testing will help NHTSA better understand system functionality, limitations, and the balance between on-road rollover resistance and responsiveness**
- **2006 understeer mitigation research will broaden NHTSA's knowledge of ESC functionality, and facilitate a more comprehensive evaluation of ESC performance**

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Additional Information

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- **NHTSA's ESC Docket**
  - **http://dms.dot.gov/search/searchFormSimple.cfm**
  - **Docket Number 19951**
- **VRTC ESC Website**
  - **http://www-nrd.nhtsa.dot.gov/vrtc/ca/esc.htm**

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