HR-7-13

#### FMVSS 202a Dynamic Evaluation of the Volvo WHIPS Seat

Ford Presentation to NHTSA

## FMVSS 202a Alternative Dynamic Test

- . Examine field performance of Volvo WHIPS seats versus performance in NHTSA's dynamic tests.
- . Functional equivalency of the dynamic and static requirements.
- . Suggested modifications of the dynamic requirements

## Volvo WHIPS Seat: Real-World Performance

- Comparing Volvo seats with WHIPS to the previous-generation Volvo seats (Jakobsson and Norin, IRCOBI 2004).
  - There was an 18% reduction for initial soft tissue neck injuries.
  - For soft tissue neck injuries lasting more than 1 year, there was a 36% reduction.
- IIHS reported a 49% reduction in neck injury claim rates with WHIPS compared to previous generation seats (IIHS status report, 10/2002).

#### Volvo WHIPS Seat: Public Ratings

IIHS/IIWPG (2005)

 All tested models rated "Good"
 \$40, \$60, \$80, \$200

 Folksam/SRA (2005)

 All tested models rated Green
 \$40, \$50, \$60, \$70, \$80, \$200

#### FMVSS 202a Alternative Dynamic Sled Test: Volvo S80

		Test 1	Test 2	Average	Requirement
Static Backset (mm)				13 (n=15)	55
Backs (mm)	set in Test	55	50	52.5	
	-Torso e (Deg)	15.9	16.6	16.3	12
C7/T <sup>·</sup> (Nm)	1 –My	50	41	45.5	

# FMVSS 202a Alternative Dynamic Test Concerns

- The 12 degree head-torso rotation requirement may not be functionally equivalent to the static requirements.
  - Minimum height
  - Backset (Front outboard seating positions)
  - Gaps
  - Energy Absorption
  - Height Retention
  - Backset retention, displacement and strength
- The 12 degree head-torso rotation requirement may be design/technology restrictive.

## NHTSA Risk of Injury Probability Curve: Basis

- Based on paired tests of Saab seats with and without the Self Aligning Head Restraint (SAHR)
  - The head-torso rotation was obtained via film analysis using "phantom" reference targets (Viano).
    - Not the method required by FMVSS 202a where instrumentation error is +/- 1.5 deg compared to film analysis (Voo et al., SAE 2003-01-0174).

Viano 2002, "Role of the Seat in Rear Crash Safety"

#### Film Analysis: "Phantom" Reference Targets

HR-7-13



• Viano, Role of the Seat in Rear Crash Safety, SAE 2002.

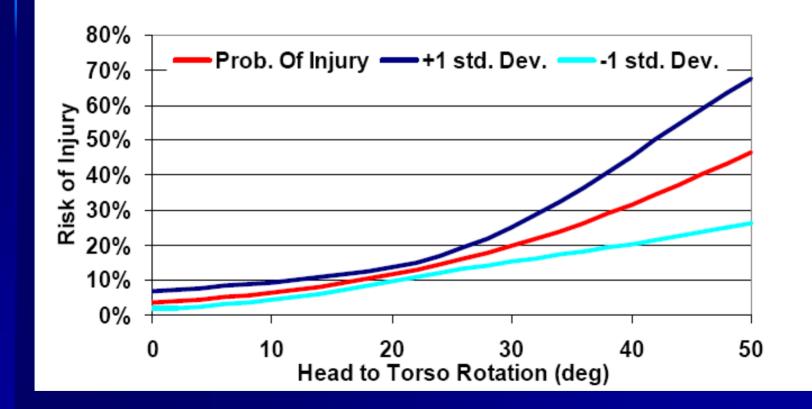
## **Dynamic Test Option: 12 Degree Injury Criterion**

- Based on one type of seat: with SAHR(Saab 9-3) and without SAHR (Saab 9000)
  - At 16 km/hr  $\Delta V$  (approximates Dynamic Test Alternative  $\Delta V$  of 17.3 km/hr)
    - Two tests with Saab 9-3 (SAHR)
    - Two tests with Saab 9000 (w/o SAHR)

12 Degree injury criterion may not accurately represent other head restraints/ seats (including other active systems)

Ref: NHTSA 2004-19807-5

#### NHTSA Head to Torso Rotation Risk of Injury Curve



HR-7-13

#### **Dynamic Test Proposal**

- Increase the head-to-torso rotation limit to 20°
  - Approximately represents a 11% risk of whiplash injury (AIS 1) according to the NHTSA probability curve.
  - Significantly lower than the 18.8% injury risk level allowed for moderate head injuries (AIS 2) by the HIC requirement of 500.
  - Will be less design restrictive.