

WORLDSID STATUS 50TH MALE AND 5TH FEMALE

SAE Government Industry Meeting:

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Agenda

- Results of moving deformable barrier (MDB) testing
 - 50th male test results
 - 5th female rear seat test results
- Status of ongoing work with WorldSID 5th female

Test Fleet

2010 Ford F150	2010 Buick LaCrosse	2011 Hyundai Sonata	2010 Chevy Traverse	2010 Acura MDX	2010 Suzuki SX4	2010 Kia Forte	2011 Hyundai Tucson	2011 Cadillac CTS	2011 Jeep GR Cherokee	2011 Ford Explorer	2011 Honda Odyssey	2013 Chevy Traverse
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- Comparison with SNCAP tests
 - Comparison vehicles are in the 4-year model span (MY 2010-2014)
 - Test Speed: 38.5 mph
 - Test Dummies: ES2-re and SID-IIs
- 2013 Chevy Traverse with driver inboard head/thorax bag
 - Tested with 2- 50th male dummies in front seat

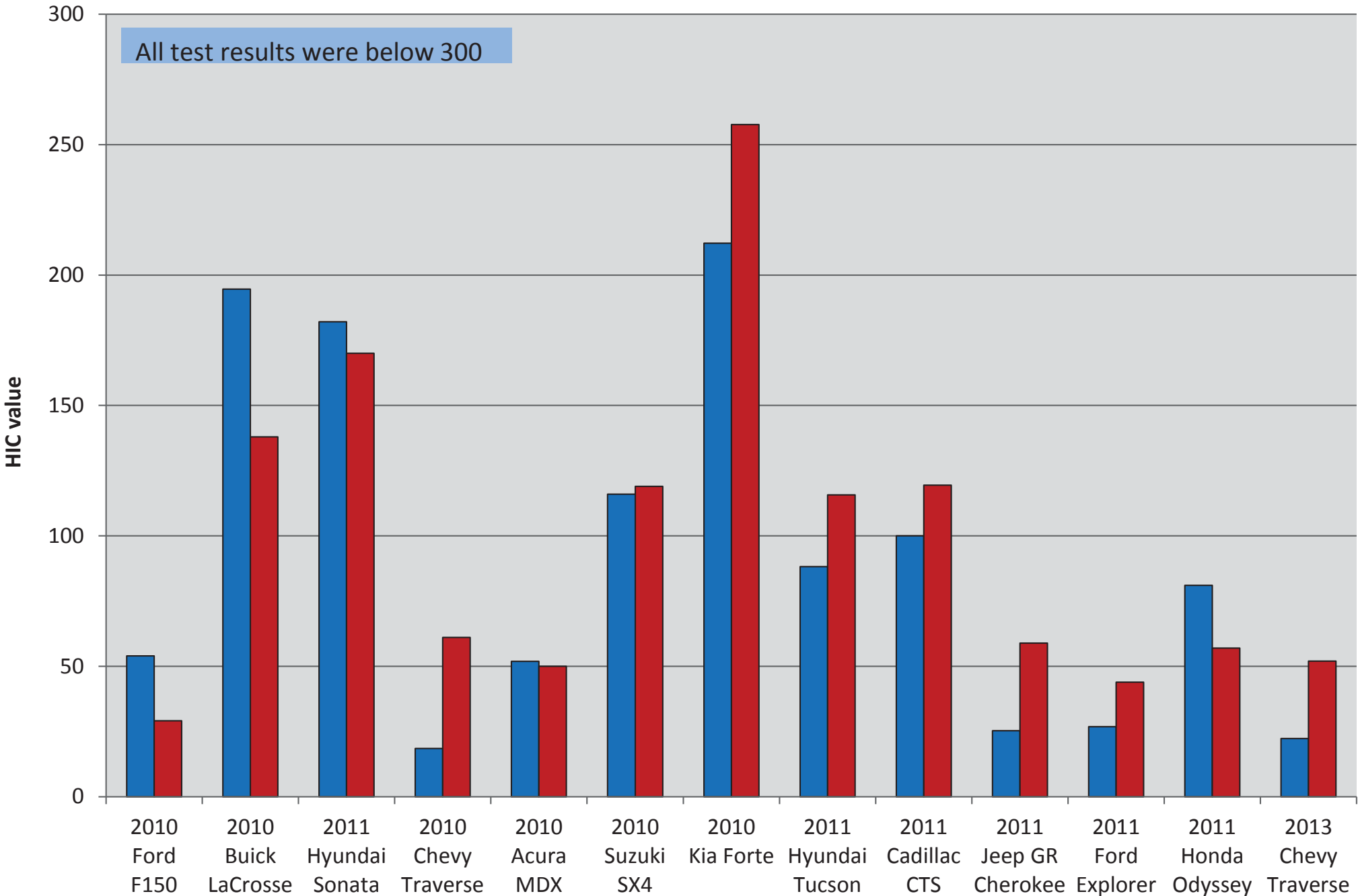
50th Male Seating Positioning

- WorldSID seating procedure used for this testing
 - Use FMVSS 214 seat cushion setup (mid angle / lowest height) with seat track at midtrack-20mm
 - Seat the dummy using the FMVSS 214 test protocol
 - Oscar the seat using J826 per current standard
 - H-point tolerance (add 20mm ± 5mm)
 - Use tilt sensors to level the head and thorax ($\pm 2.5^\circ$)

Reference: 2011 & 2012 Government Industry Presentation for additional details on seating procedure

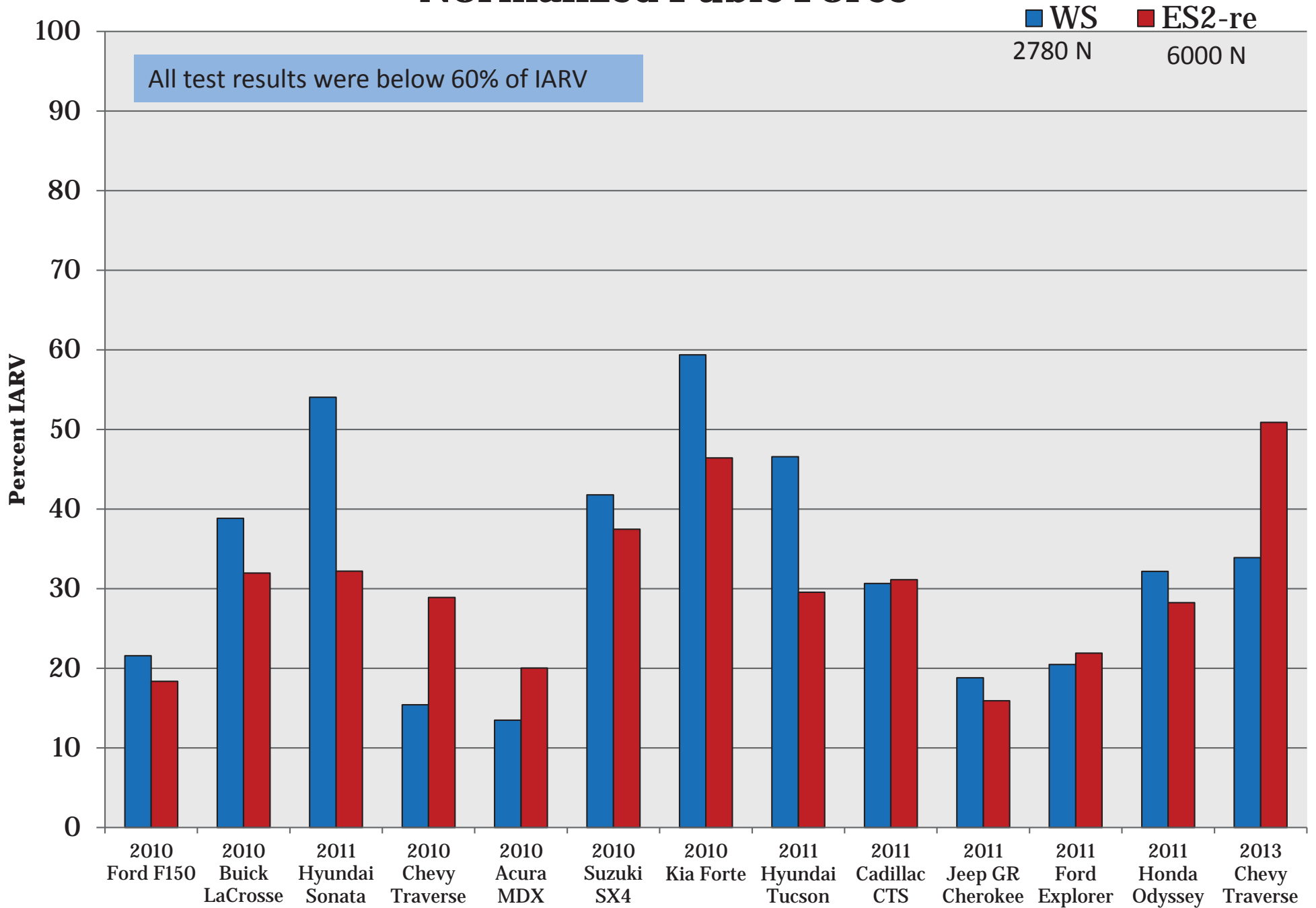
HIC 36

■ WS ■ ES2-re

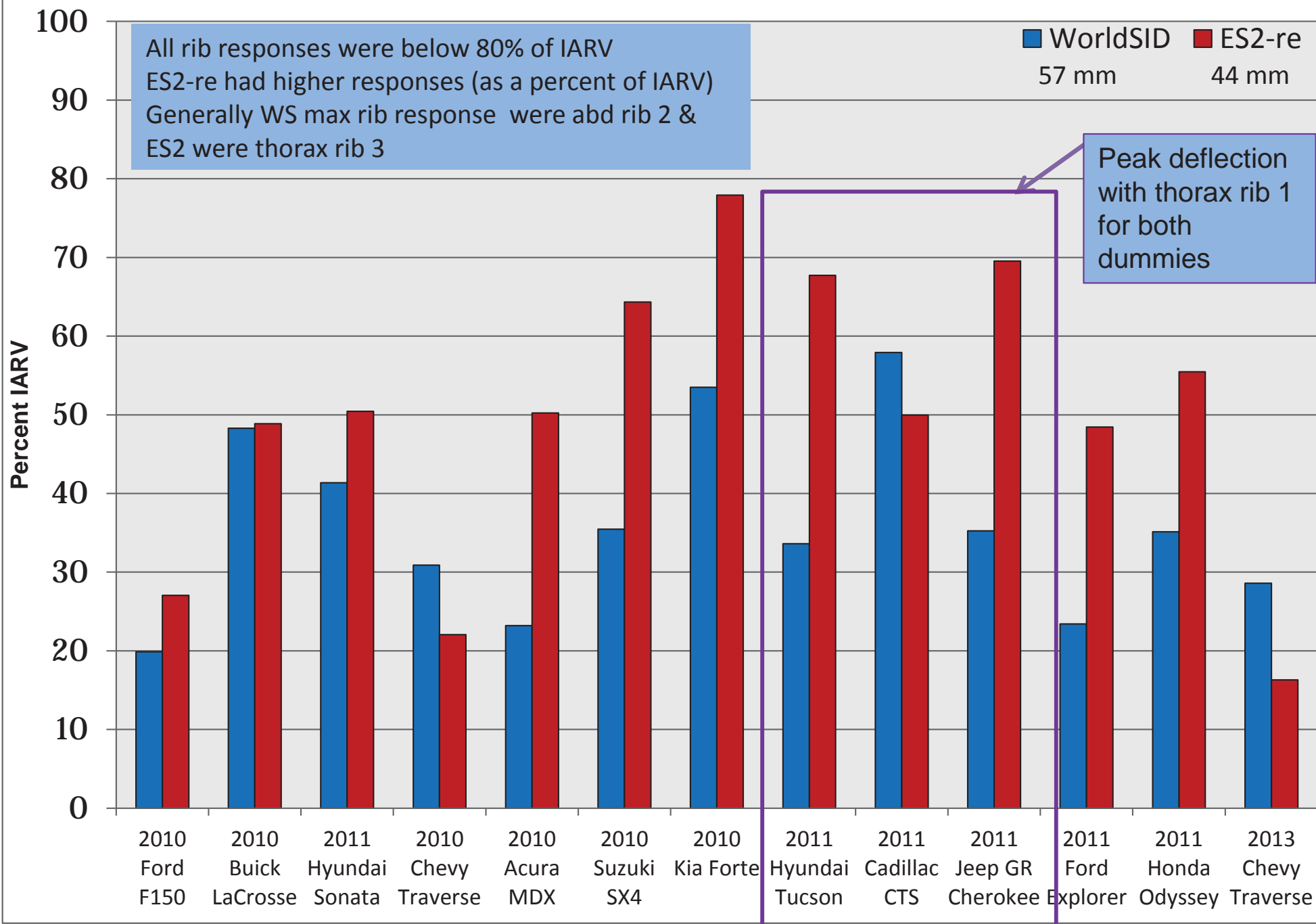


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Normalized Pubic Force

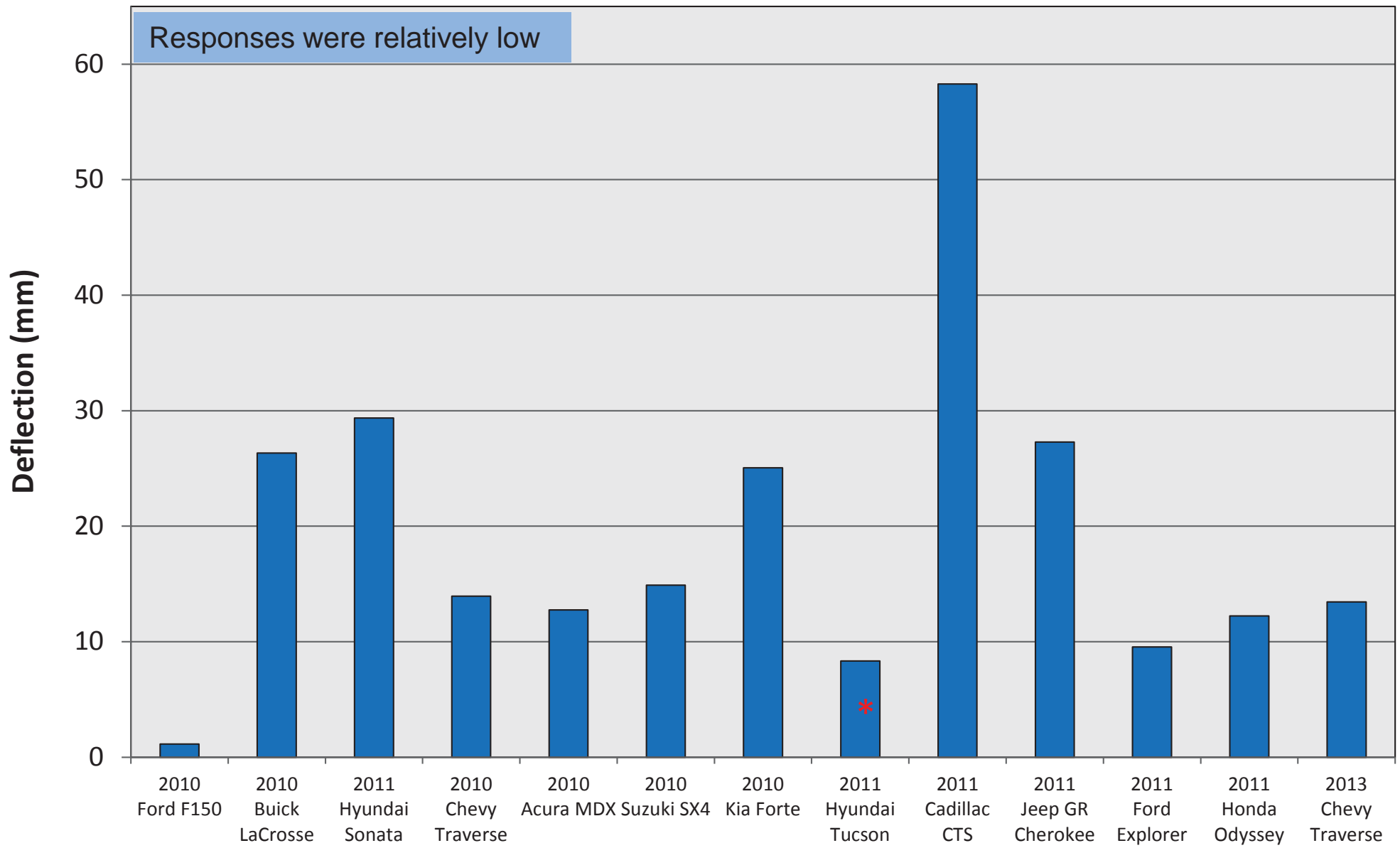


Maximum Rib Deflection (Normalized)



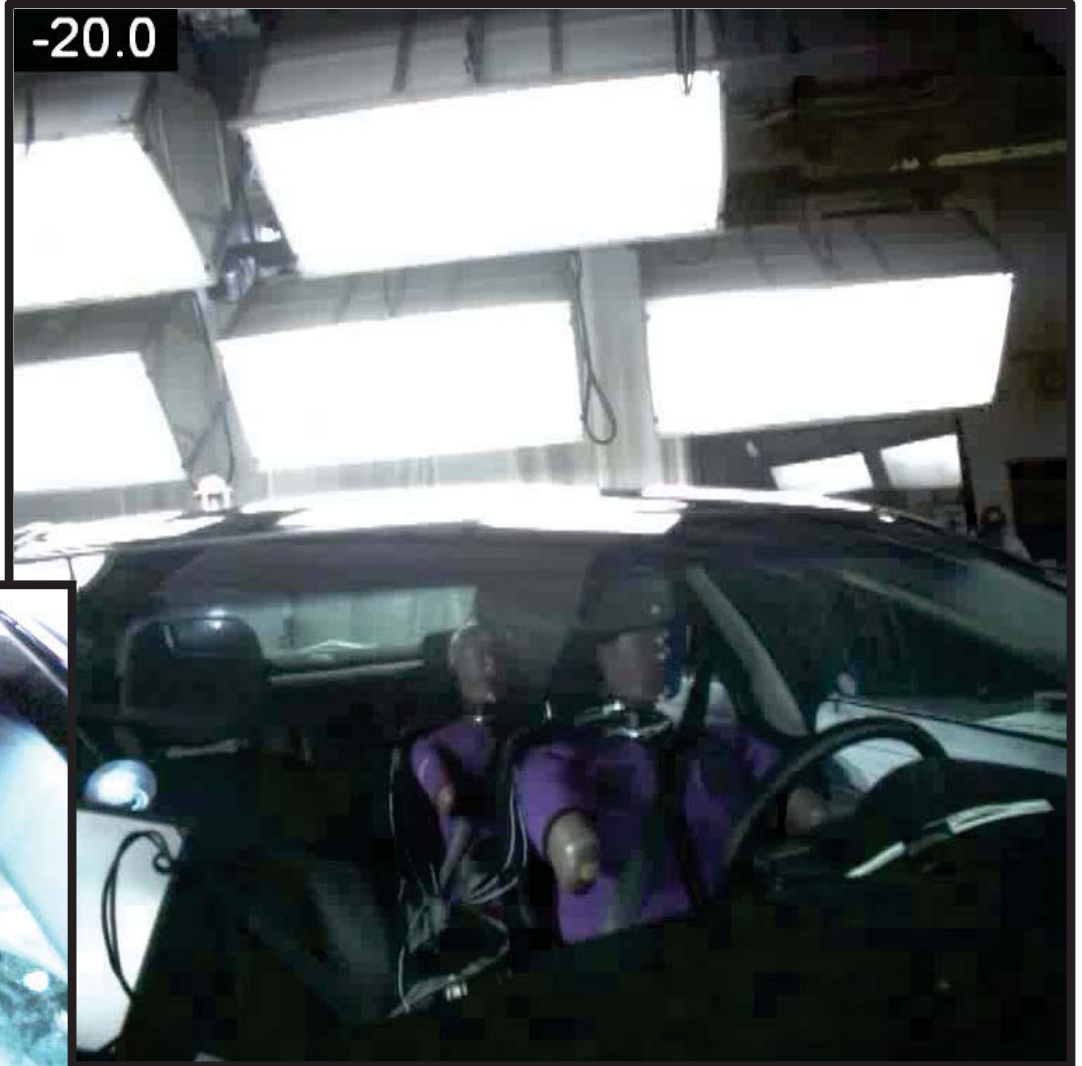
Shoulder Deflection

■ WorldSID



* Questionable data after 34ms

2011 Cadillac CTS



Curtain air bag did not deploy in front of the b-pillar- possibly could have caused more or less shoulder injury.

Summary of 50th Male: MDB Test Results

- Overall kinematics very similar for WorldSID 50th and ES2-re
- All responses were below IARVs for all vehicles for both dummies
 - All HICs were below 300 and were similar for both dummies
 - All pubic forces were below 60% of IARV, but they were more often higher in the WorldSID
 - Rib responses were all below 80% of IARV but were generally higher for the ES2-re (as a percent of IARV)
 - The WS maximum rib response were mostly from the abdomen rib2 and ES2 thorax rib 3
 - The Hyundai Tucson, Cadillac CTS, Jeep Cherokee had peak deflections with thorax rib 1 for both dummies

Summary of 50th Male: MDB Test Results, Continued

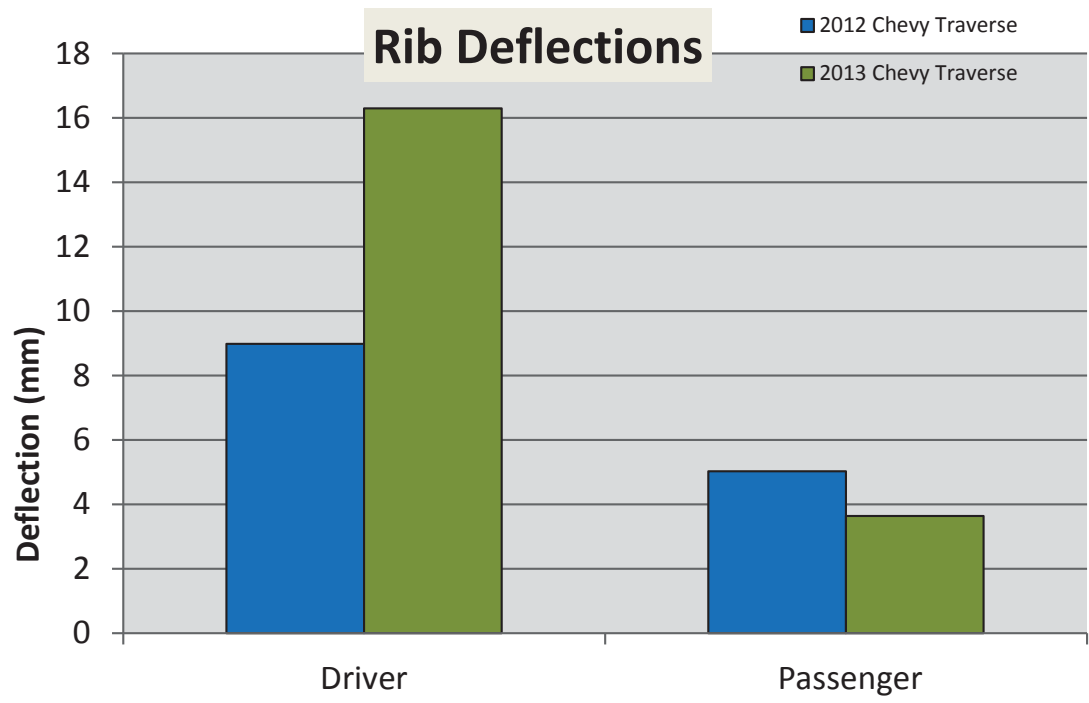
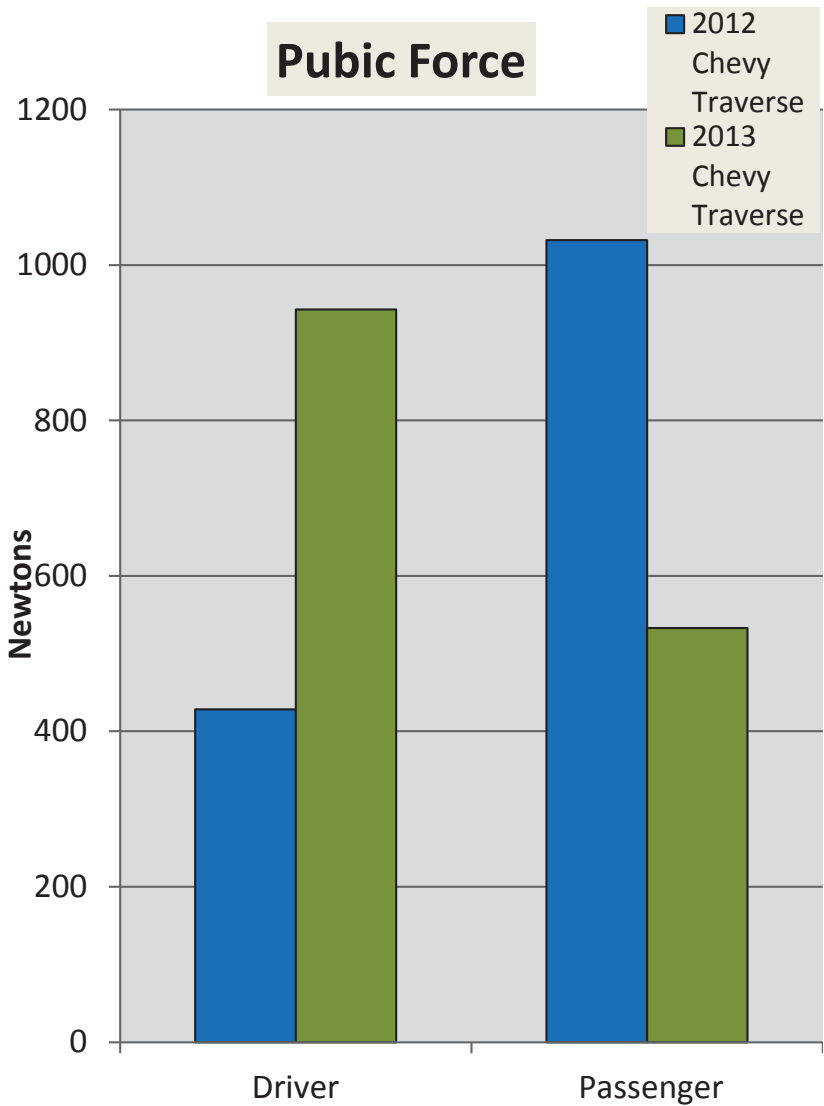
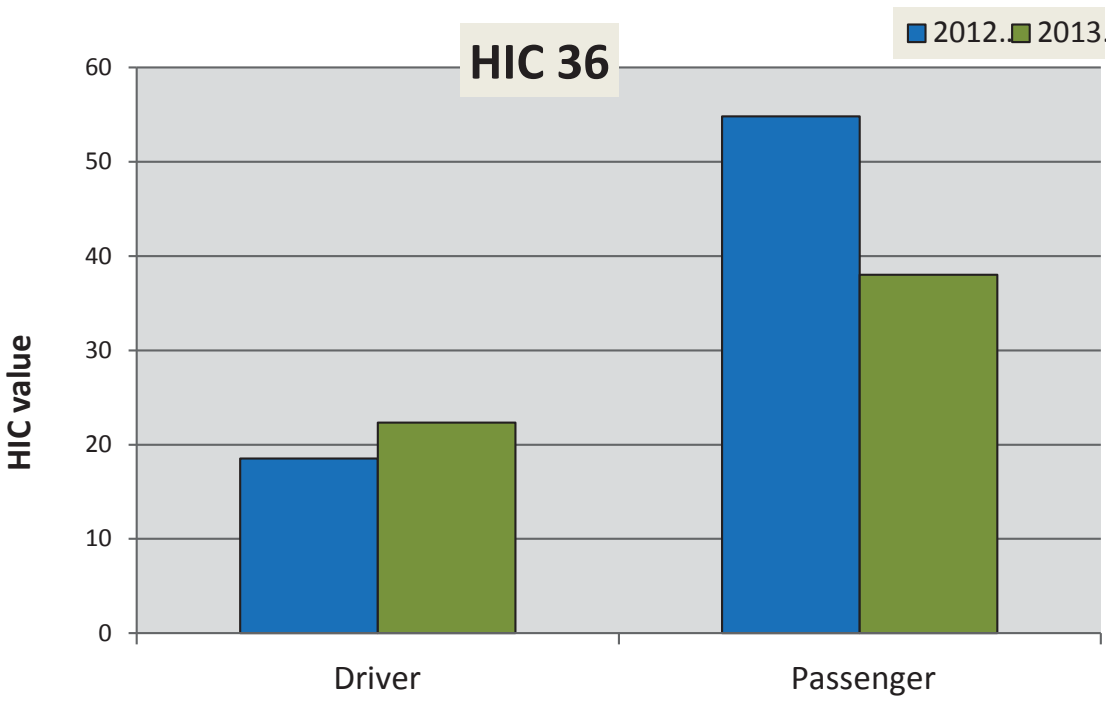
- Shoulder deflection, lower spine and pelvic accelerations were not measured with the ES2-re. For the WorldSID:
 - Shoulder deflections were relatively low (below 30 mm, except CTS)
 - Elevated response in the Cadillac CTS (58 mm)
 - Driver dummy sits down in the vehicle, airbag caught in B-pillar
 - Hyundai Tucson had questionable data during impact
 - Arm may have been caught between the thorax side air bag/curtain and B-pillar
 - Lower spine and pelvic accelerations were low except for one vehicle
 - 2010 Kia Forte pelvis resultant acceleration was elevated (~84g's)
- WorldSID dummy: very durable
 - Nothing damaged

2013 Chevy Traverse: Inboard Thoracic Airbag



Dummy responses were low

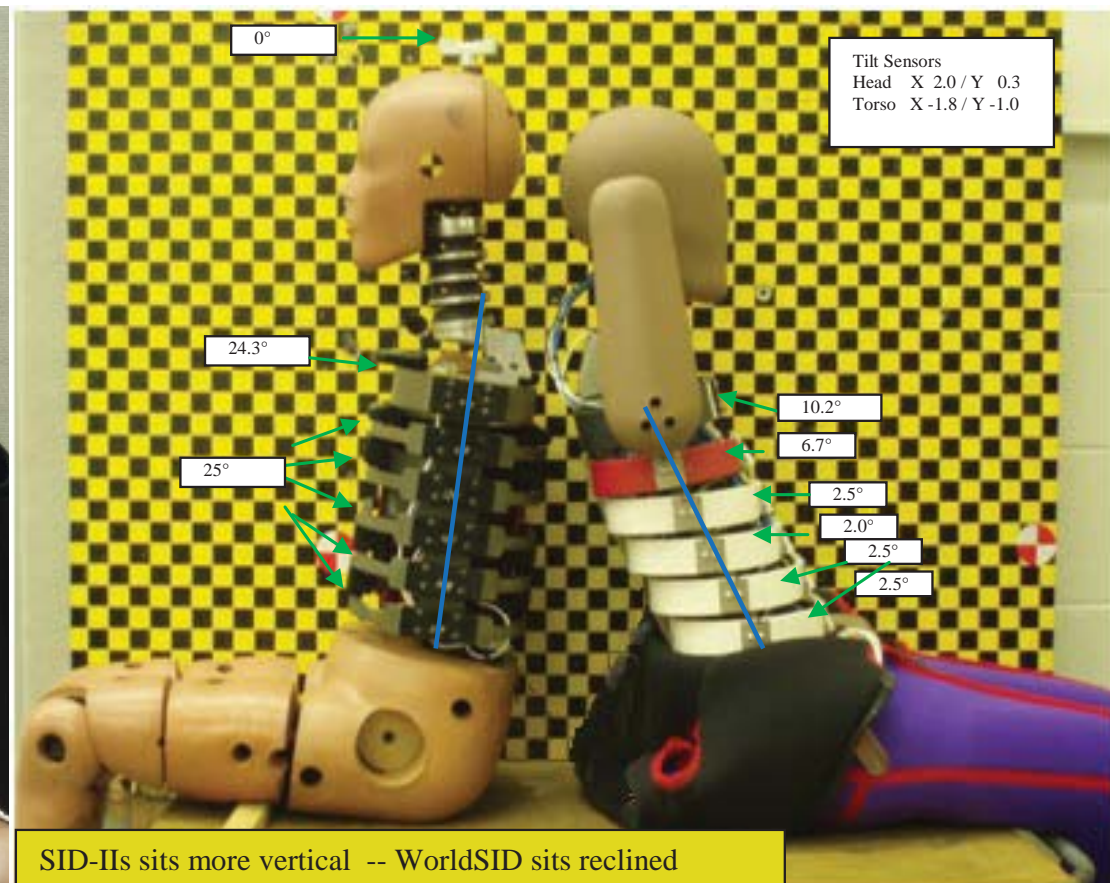
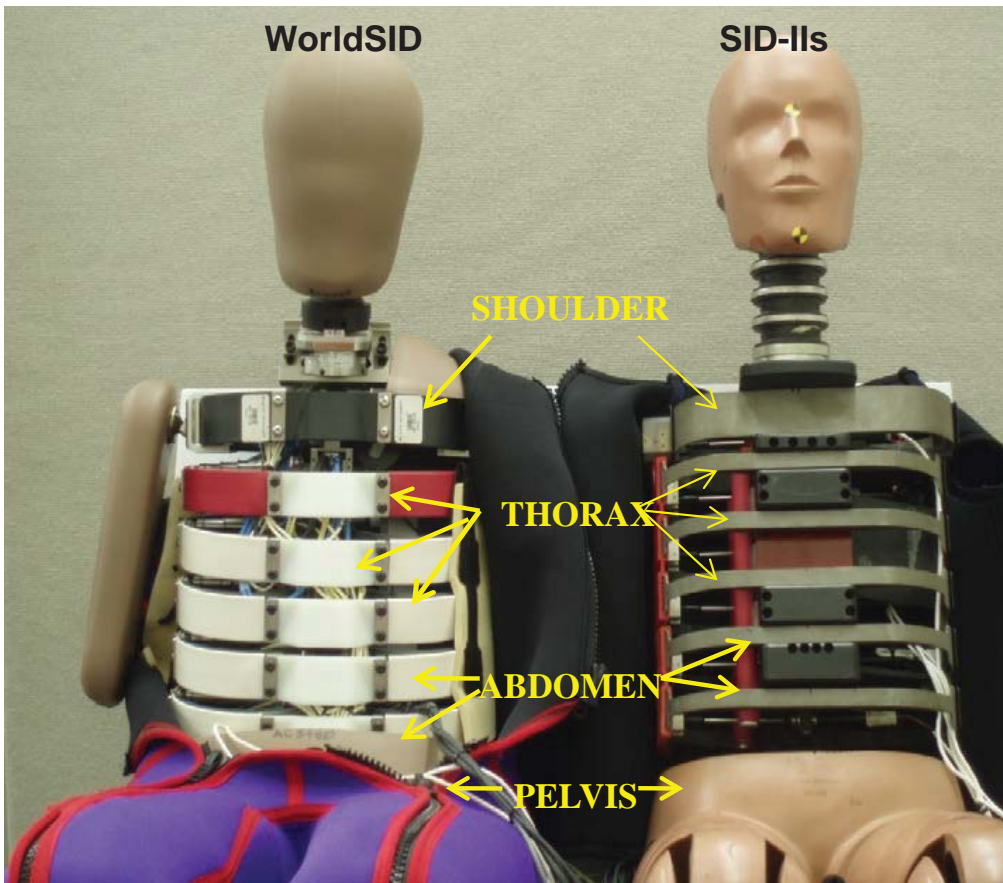
Chevy Traverse with and without inboard thorax bag: low results



Summary of 50th Male: MDB Test Results

- Overall kinematics very similar for WorldSID 50th and ES2-re
- All responses from the 50th male WorldSID were similar outcomes to those from the ES2-re vehicle tests.
- WorldSID dummy: very durable
 - Nothing damaged
- All of the tests are located on the NHTSA database.
 - <http://www.nhtsa.gov/Research/Databases+and+Software>

SID-IIs vs WorldSID 5th



External Dimensions

	SID-IIs	WorldSID 5th
Overall Height	773 mm	774 mm
Shoulder/neck Height	473 mm	510 mm
Back to Front of Knee	532 mm	578 mm
H-Point to Front of Knee	386 mm	420 mm
Top of Knee to top of Shoe	400 mm	435 mm
Shoulder Width	348 mm*	398 mm
Thorax Width	293 mm	302 mm
Pelvis Width	319 mm	374 mm
	* SID-IIs only has 1 arm to measure shoulder width where as the WorldSID has 2	

Seating Procedure

- Initial look
 - Use the SID-IIs seating procedure protocol in FMVSS 214 and previous experience with the WS 50th
 - Seat cushion setup (mid angle / lowest height) determined in the rear most position
 - Seat full forward or until knees contact dash and seat back adjusted full upward or until head is level
 - Used tilt sensors in the head and thorax to determine final position
 - Monitored the pelvic angle and pelvis sensor

General Results/Observations

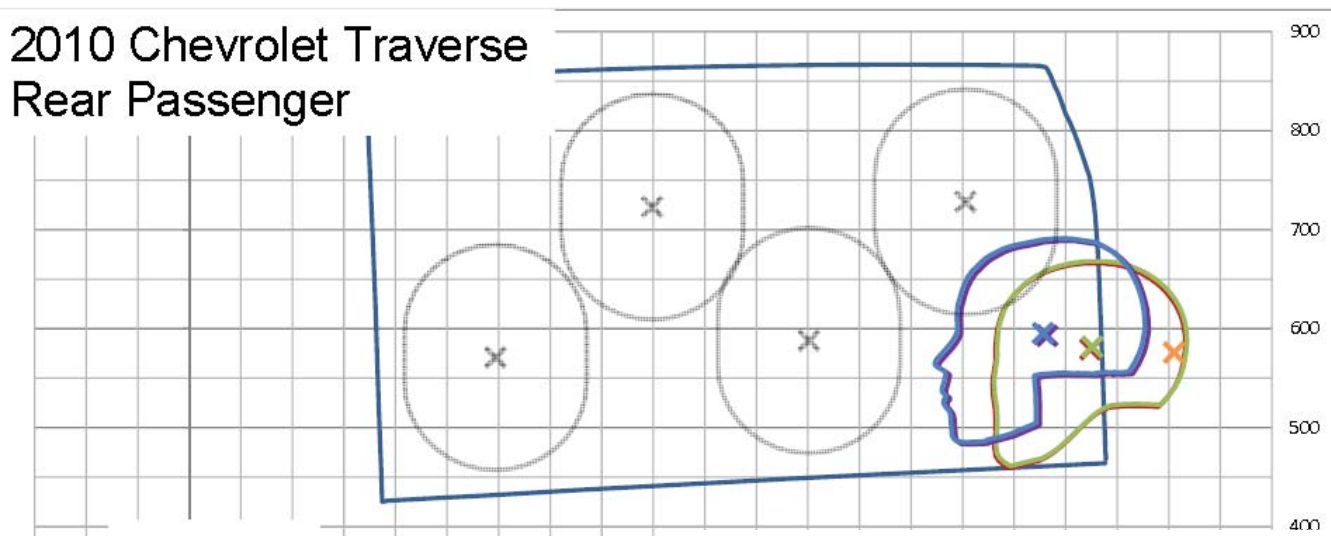
- WorldSID legs are longer than SID-IIs
- WorldSID ankles don't articulate like SID-IIs
- WorldSID head and ribs are more rearward with respect to the H-point
- WorldSID head CG typically was lower and rearward for all occupants
- WorldSID H-Point:
 - Driver and right front passenger typically same as SID-IIs in X direction, but slightly higher in the Z-direction
 - Rear passenger more forward (X-dir) and slightly higher (Z-dir) than SID-IIs

Potential Issues

- Rear Seat
 - Seatbacks had limited adjustability (5 vehs)
 - Head leveling issues
 - Final head position slightly different
 - Alignment of ribs with door different in some vehicles
 - Limited ankle articulation
 - Feet sometimes cannot get under front seat, which causes knees to be higher



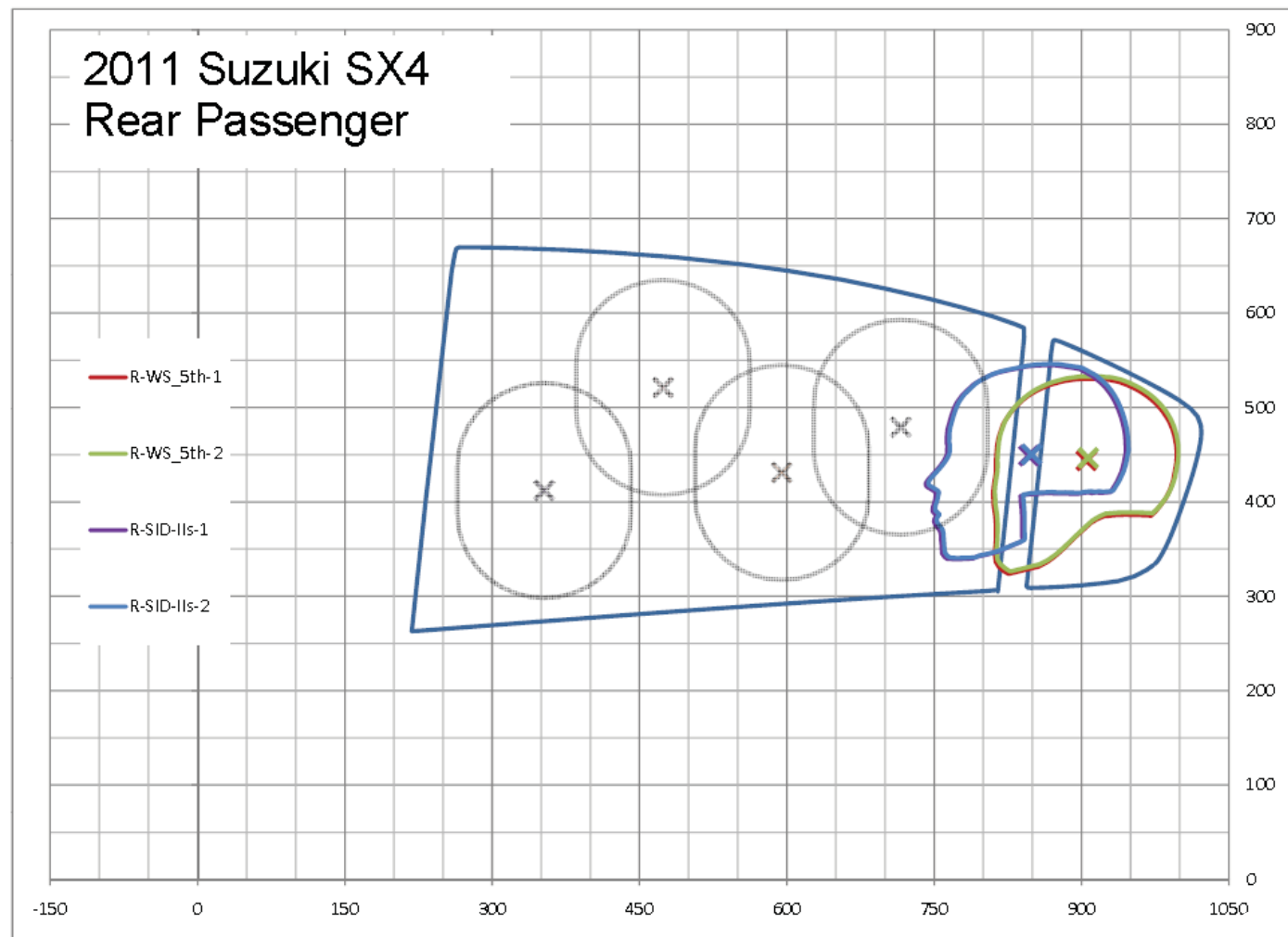
2010 Chevrolet Traverse Rear Passenger



- R-WS_5th-1
- R-WS_5th-2
- R-SID-11s-1
- R-SID-11s-2

-150 0 150 300 450

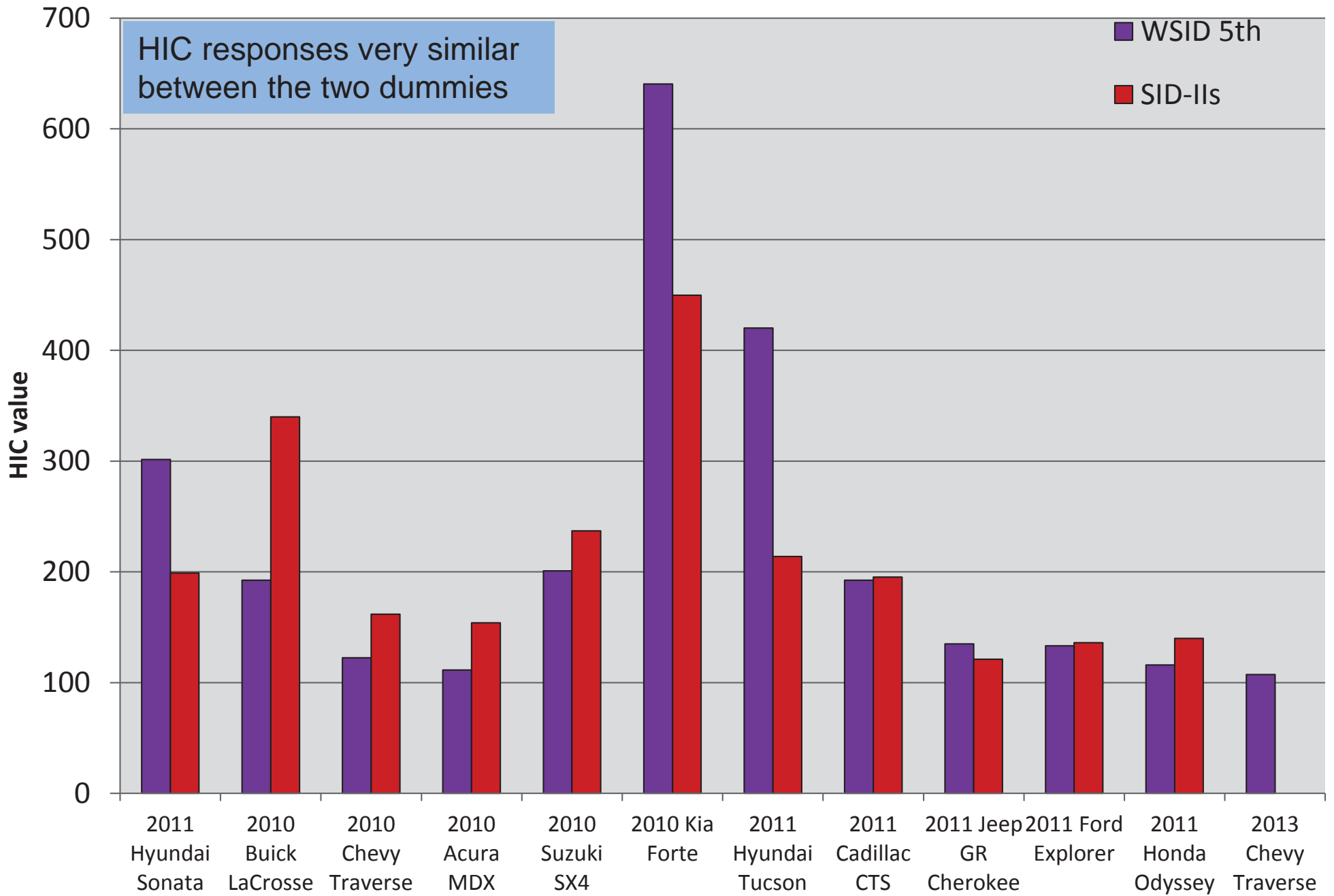
2011 Suzuki SX4 Rear Passenger



- R-WS_5th-1
- R-WS_5th-2
- R-SID-11s-1
- R-SID-11s-2

-150 0 150 300 450 600 750 900 1050

HIC 36



-50.0

Kia Forte



Figure A-74: Post-Test Rear Passenger Dummy Close-Up Head Contact with Side Airbag View.

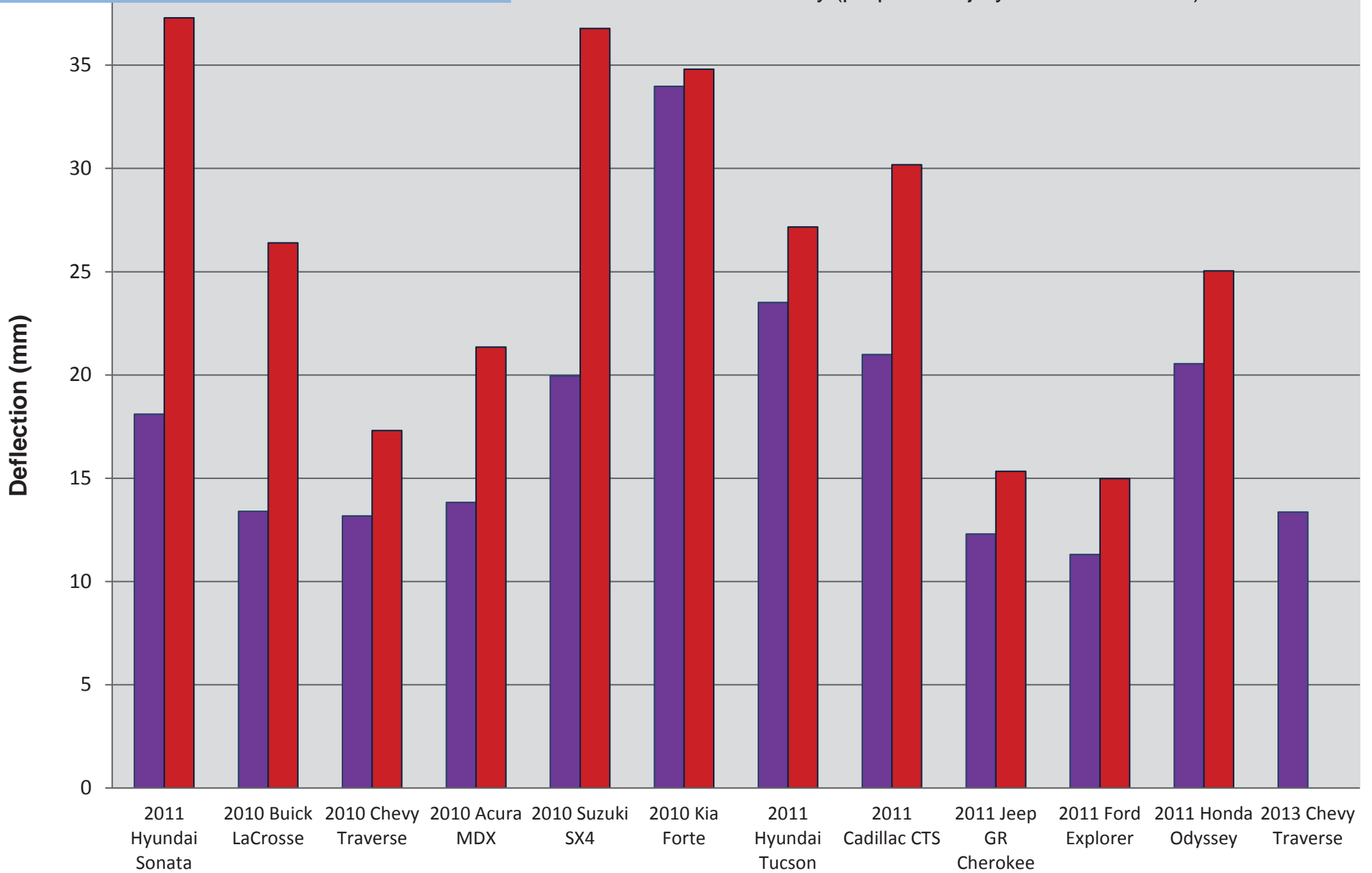
Rib deflections all below 40mm
 SIDIIs max rib was from abd rib 1
 WS max rib was from thorax rib 1

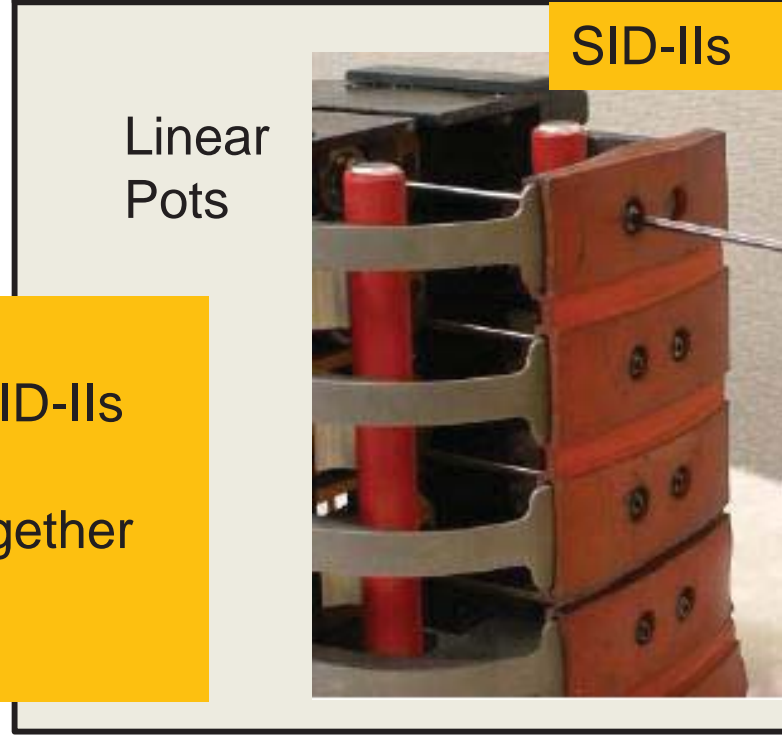
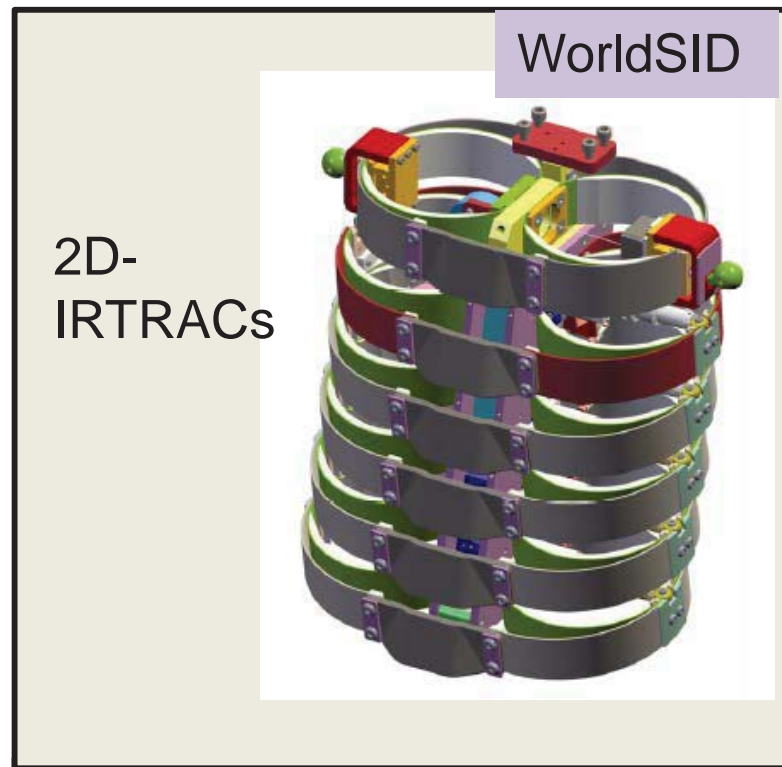
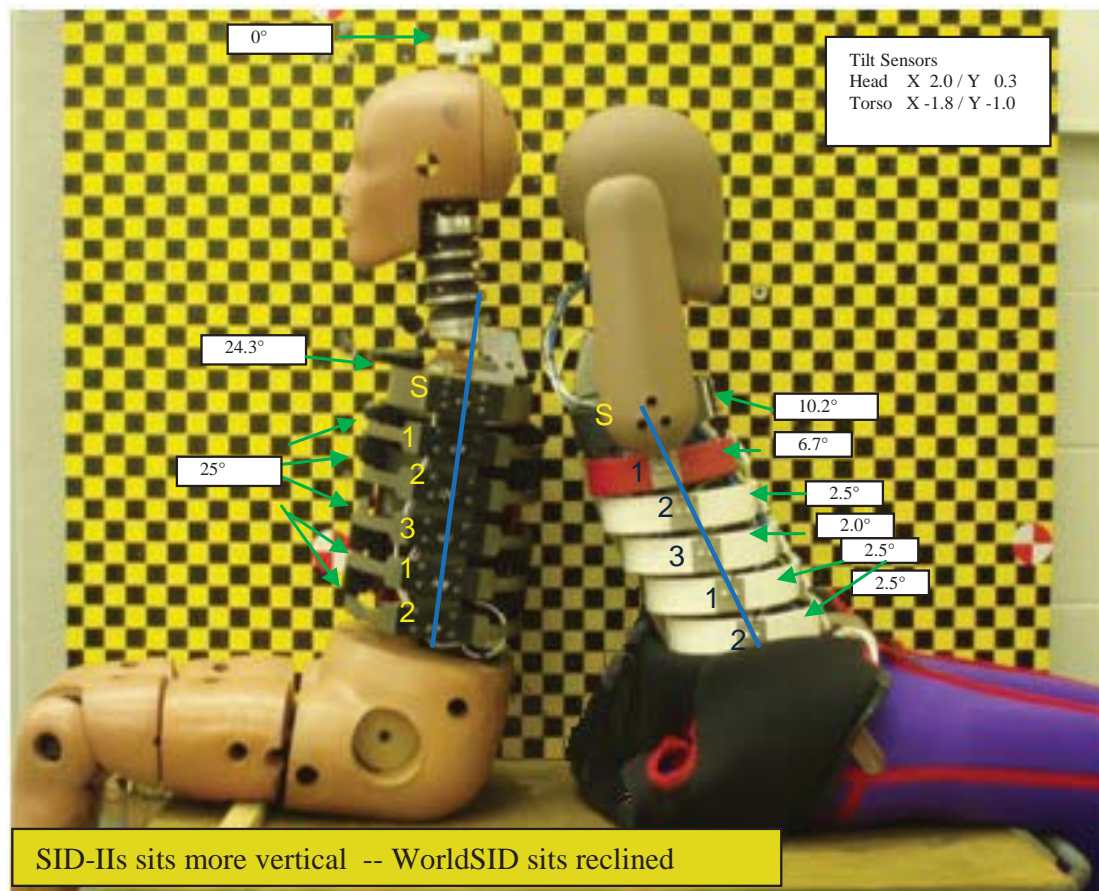
Maximum Rib Deflection

■ WSID 5th

■ SID-IIs

Previous study (proposed injury criteria for SIDIIs): 38mm/45mm





Question:

Can WS 5th ribs be directly compared to the SID-IIs ribs?

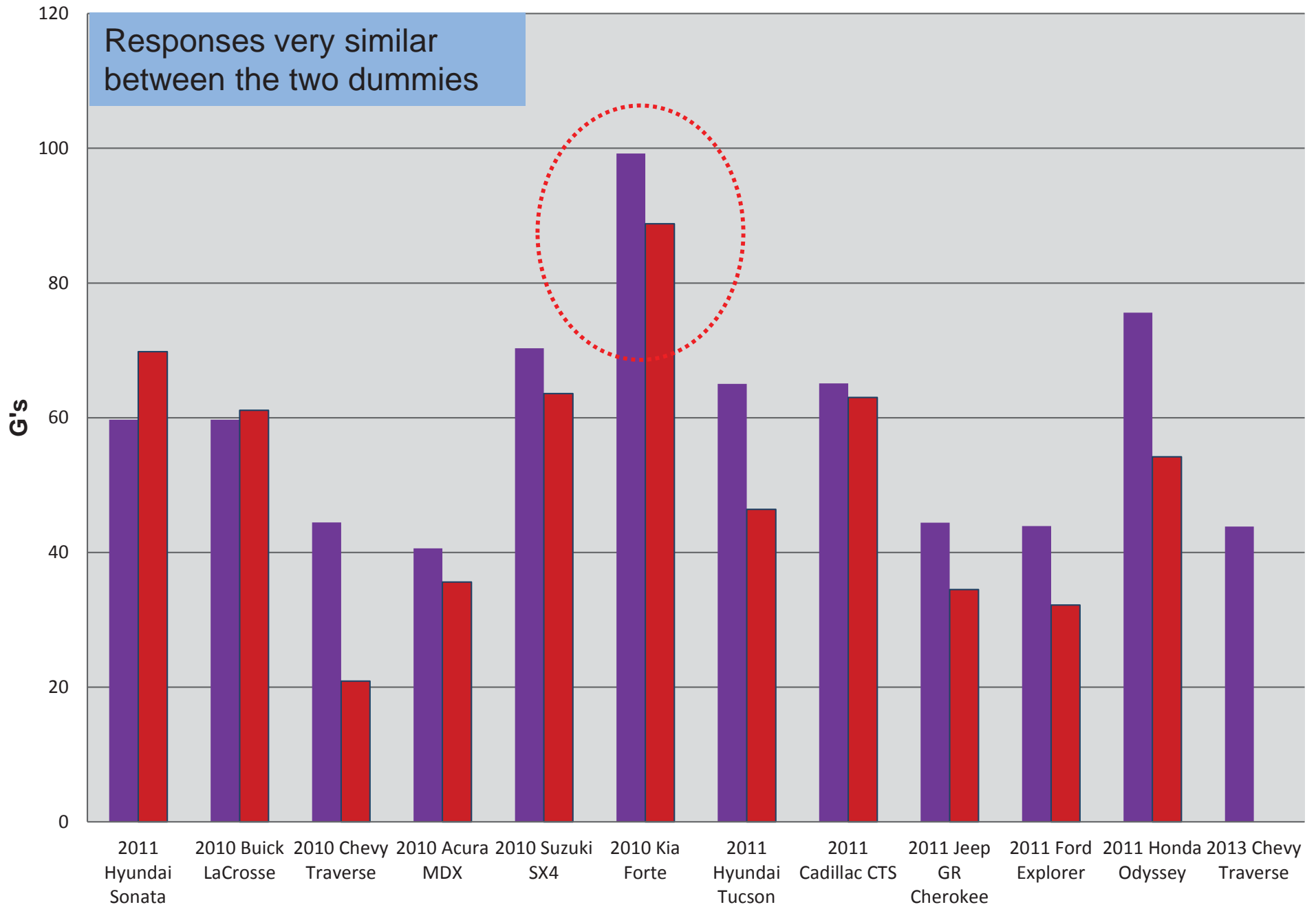
- SID-IIs has linear pots and ribs all move together
- WS 5th has IRTRACs and ribs can move individually

Hyundai Sonata



WorldSID Lower Spine G's

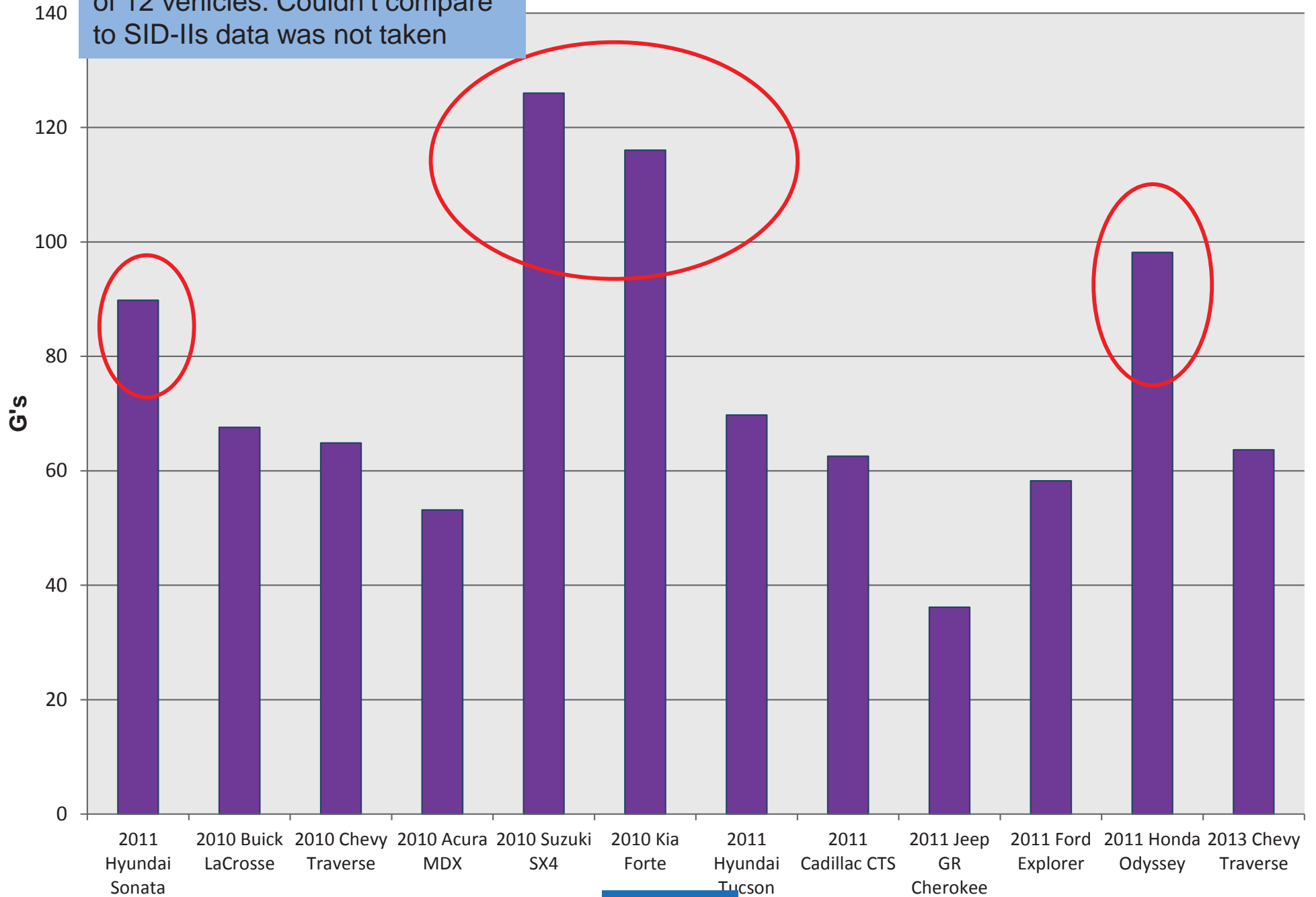
■ WSID 5th ■ SID-IIs



Pelvic Resultant Acceleration

■ WSID 5th

Responses were higher for 4 out of 12 vehicles. Couldn't compare to SID-II's data was not taken



Kia video

Summary of 5th Female: MDB Test Results

- Overall kinematics very similar for WorldSID 5th and SID-IIs
- All [HICs](#) were below 650 and were generally similar for both dummies
 - Somewhat higher for WorldSID in Kia Forte, Hyundai Tucson, and Hyundai Sonata
- [Maximum Rib](#) deflections were all below 40 mm
 - Rib deflections were higher with SID-IIs in every test.
 - Hyundai Sonata and Suzuki SX4 had the largest difference
 - WS 5th: Maximum rib deflections were mostly from abdomen rib 1
 - SID-IIs: Maximum rib deflections were mostly thorax rib 1.
- [Lower spine](#) peak accelerations were similar for both dummies
 - 2010/11 Kia Forte results were high for both SID-IIs and WS5th
- Shoulder deflection, pubic symphysis, and pelvic accelerations were not measured with the SID-IIs. For the WorldSID:
 - Shoulder deflections were all below 35 mm
 - Pubic symphysis forces were all below 1400 N
 - [Peak pelvic accelerations](#) were above 80 g's in 4 of 12 vehicles.
- WorldSID dummy: very durable
 - Nothing damaged

Summary of 5th Female: MDB Test Results

- Overall kinematics very similar for WorldSID 5th and SID-IIs
- Responses similar to those of the SID-IIs
- Rib deflections were all below 40mm, the SID-IIs responses were higher than the WorldSID responses
 - Ribs are designed differently than each other
- WorldSID 5th dummy: very durable
 - Nothing damaged

Status: WorldSID 5th female

- Seating procedure
 - Driver and front seat positions
- Dummy design concerns/issues
 - Pelvis contact
 - Lumbar and side impact load cell
 - Shoulder contact with neck base
 - Material changes (head and pelvis)
 - Injury criteria development

Thanks for your attention

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