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WorldSID 50th Update

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44th GRSP Session
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Outline

- ▶ Retrospective
- ▶ ISO - WorldSID 50th Evaluation
- ▶ NHTSA - WorldSID 50th Evaluation
- ▶ Further Activities
- ▶ Summary

Retrospective

- ▶ **Last WorldSID Update at 42nd session in December 2007**
- ▶ **Release of WorldSID 50th production version on March 9th, 2004**
 - **Developed by over 45 organizations from around the world**
 - Governmental agencies, research institutes, automotive manufacturers
 - **Full vehicle tests covering all side impact test procedures**
 - **Extensive sled-, component- and certification test series**
- ▶ **Fully evaluated in more than 1000 tests worldwide**
 - **WorldSID meets the ISO specifications**
- ▶ **WorldSID International Standard - ISO 15830**
 - **Documentation available since 2005**
- ▶ **Start of NHTSA WorldSID evaluation in 2004**

ISO - WorldSID 50th Evaluation

- ▶ **WorldSID Biofidelity rating according to ISO TR9790**
- ▶ **WorldSID Testing conducted by OSRP, Transport Canada, and NHTSA**
- ▶ **WorldSID Task Group and NHTSA conducted similar sled tests**
 - **Data is similar between the two organizations**
 - **Calculated ISO biofidelity rating using ISO data and NHTSA data**
- ▶ **ISO evaluation finalized in 2007**

ISO - WorldSID 50th Evaluation

- ▶ Biofidelity Rating according to ISO TR9790
 - **Comparison of ES-2re vs WorldSID**



Body Region	ES-2re	WorldSID Ford (OSRP)	WorldSID NHTSA/VRTC
Head	5	10	10
Neck	4.2	5.5	5.5
Shoulder	4.5	8.3	8.3
Thorax	4.0	7.4	7.5
Abdomen	4.1	7.5	7.3
Pelvis	3.2	4.4	4.8
Overall	4.2	7.1	7.2

7.2 → **"GOOD"**

NHTSA - WorldSID 50th Evaluation

- ▶ Two instrumented WorldSID 50th provided by OSRP
- ▶ Evaluation tests conducted at NHTSA/VRTC laboratory
 - **Tests focused on:**
 - **Biofidelity**
 - NHTSA rating (Rhule 2002)
 - **Anthropometry**
 - **WorldSID full scale evaluation under FMVSS 214 test conditions**
- ▶ NHTSA - WorldSID 50th evaluation finalized in mid 2008

NHTSA - WorldSID 50th Evaluation

▶ NHTSA Biofidelity Rating (Rhule 2002)

● External biofidelity:

- Ability to replicate human loading of its environment in a crash
- Measurements made externally to human and dummy

● Internal biofidelity:

- Ability to replicate human internal response in a crash
- Internal measurements used for injury criteria

NHTSA - WorldSID 50th Evaluation

► NHTSA Biofidelity Rating (Rhule 2002)

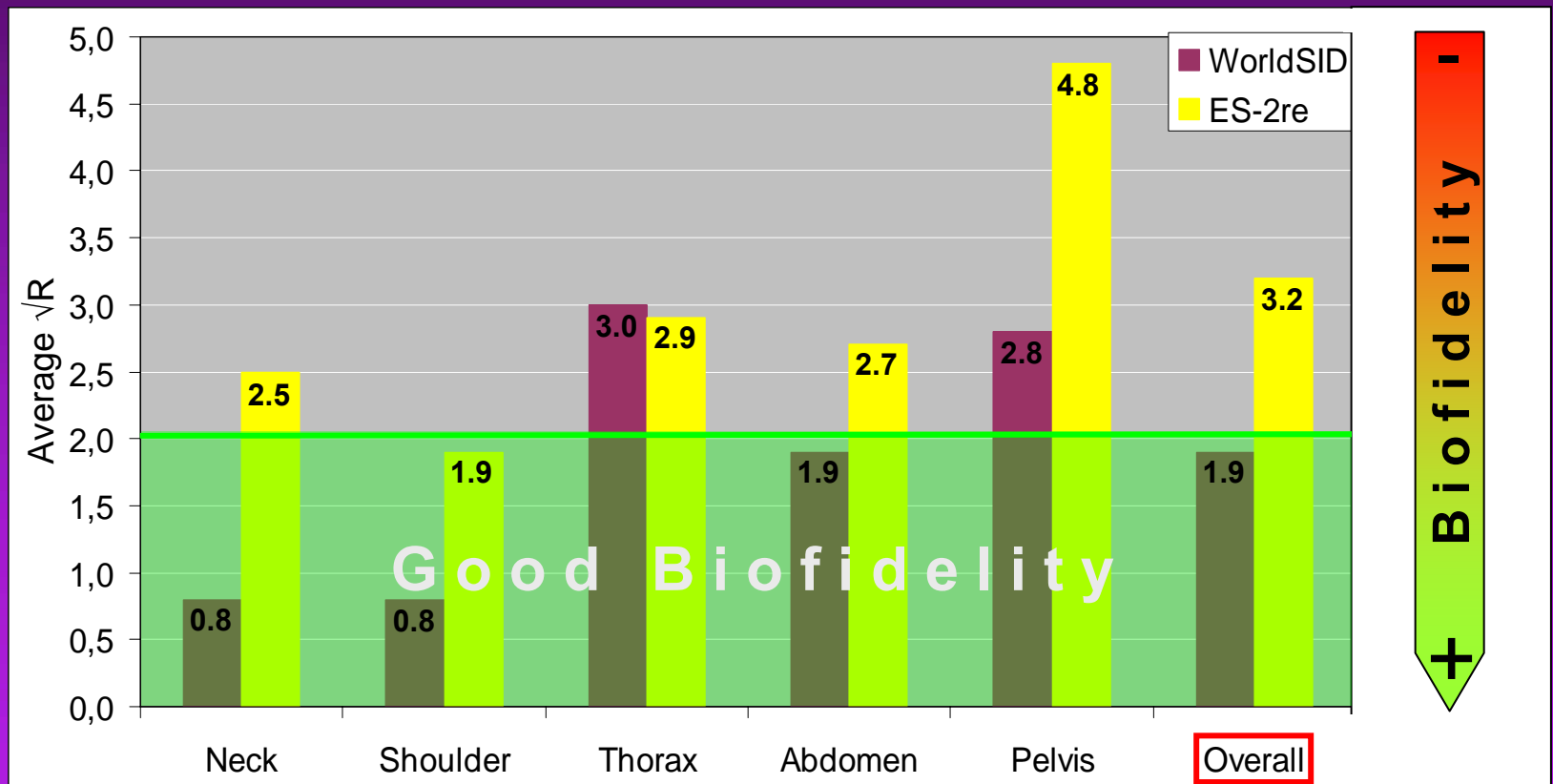
● Test matrix

Test Condition	Test Name	Reference
200 mm Rigid Lateral Head Drop	Head Test 1	ISO 9790 - Head Test 1
7.2 g Restrained Occupant Sled	Neck Test 1	ISO 9790 - Neck Test 1 & Shoulder Test 3
12.2 g Restrained Occupant Sled	Neck Test 3	ISO 9790 - Neck Test 3 & Shoulder Test 3
4.3 m/s Rigid Pendulum Lateral and Oblique Thorax Impact	Thorax Test 1	ISO 9790 - Thorax Test 1
6.8 m/s Rigid Wall Sled	Heidelberg Sled Test	ISO 9790 - Thorax Test 5 & Pelvis Test 7
6.8 m/s Rigid Wall Sled	Wayne State Sled Test	ISO 9790 - Abdomen Test 3 & Pelvis Test 10
6 m/s Rigid Pendulum Pelvis Impact	Pelvis Test 1	ISO 9790 - Pelvis Test 1
10 m/s Rigid Pendulum Pelvis Impact	Pelvis Test 2	ISO 9790 - Pelvis Test 2
4.4 m/s Padded Pendulum Lateral and Oblique Shoulder Impact	NHTSA Shoulder Test	Bolte et al. 2003
2.5 m/s Rigid Pendulum Lateral and Oblique Thorax Impact	NHTSA Thorax Test	Shaw et al. 2006
6.7 m/s Flat Rigid Wall Sled	NHTSA LS FR	Maltese et al. 2002
6.7 m/s Flat Padded Wall Sled	NHTSA LS FP	Maltese et al. 2002
6.7 m/s Rigid Abdomen Offset Sled	NHTSA LS RAO	Maltese et al. 2002
6.7 m/s Rigid Pelvis Offset Sled	NHTSA LS RPO	Maltese et al. 2002
8.9 m/s Flat Padded Wall Sled	NHTSA HS FP	Maltese et al. 2002

NHTSA - WorldSID 50th Evaluation

► NHTSA Biofidelity Rating (Rhule 2002)

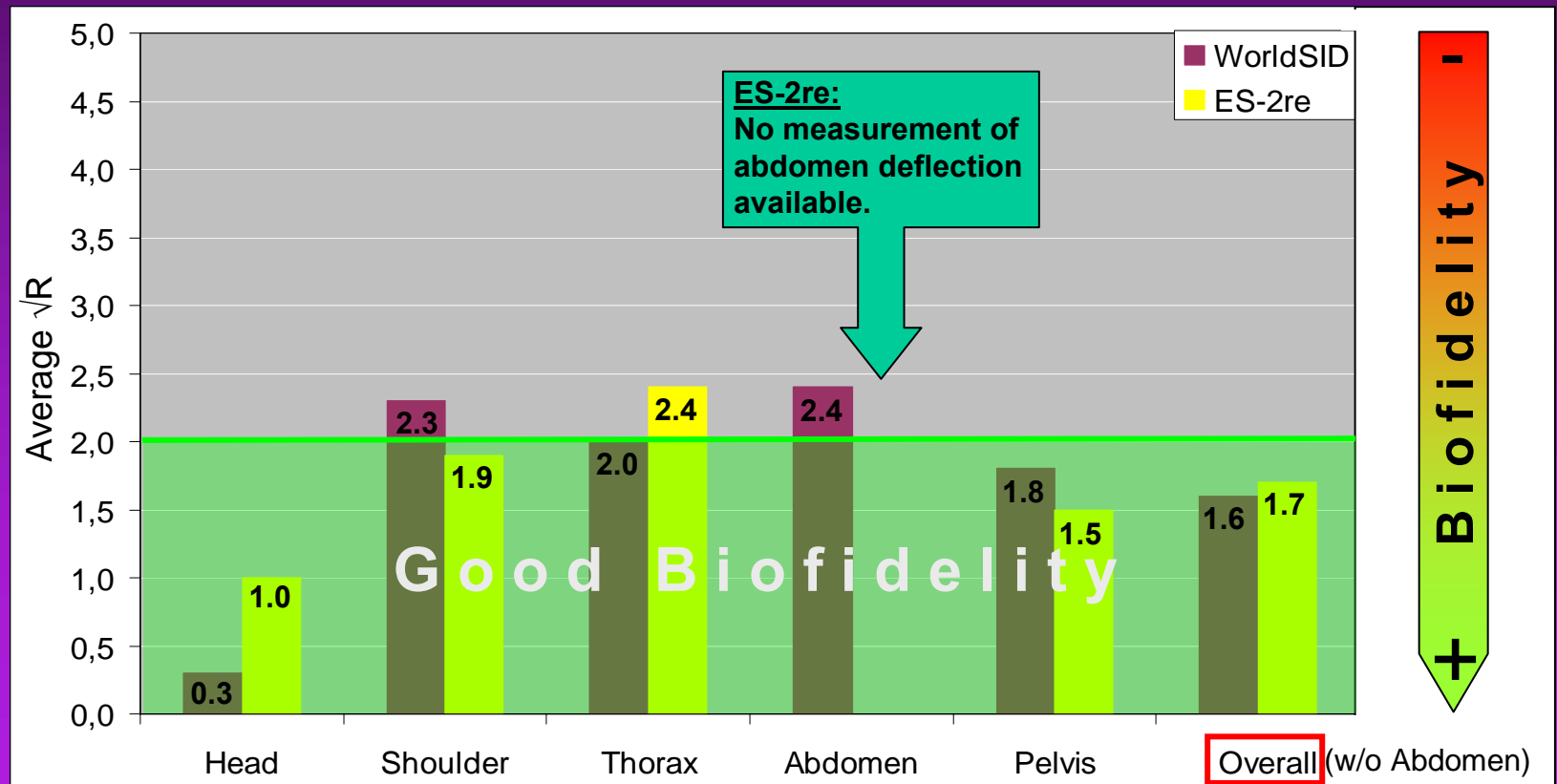
- External biofidelity - Comparison of ES-2re vs WorldSID



NHTSA - WorldSID 50th Evaluation

► NHTSA Biofidelity Rating (Rhule 2002)

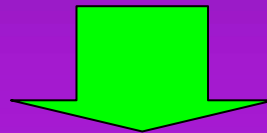
- Internal biofidelity - Comparison of ES-2re vs WorldSID



NHTSA - WorldSID 50th Evaluation

► NHTSA Biofidelity Results:

- Good repeatability
- Good reproducibility
- Good durability
- Good handling
- Good biofidelity rating according to ISO TR9790
- Good biofidelity rating based on NHTSA rating scheme



The WorldSID 50th male dummy is an improved side impact test dummy

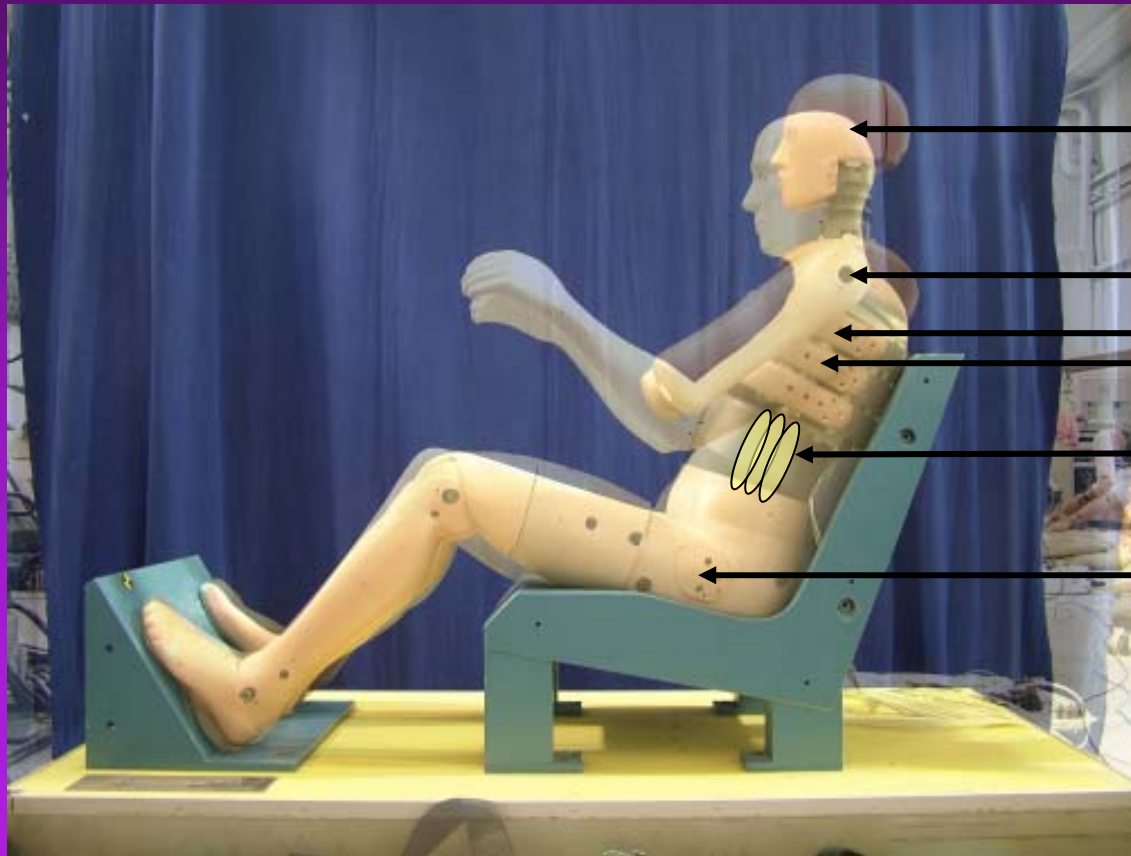
NHTSA - WorldSID 50th Evaluation

- ▶ Anthropometry study
 - **UMTRI Manikin as reference**



NHTSA - WorldSID 50th Evaluation

- ▶ Anthropometry study
 - ES-2re versus UMTRI seating



ES-2re

Head CG

Shoulder Joint

Thorax Rib 1

Thorax Rib 2

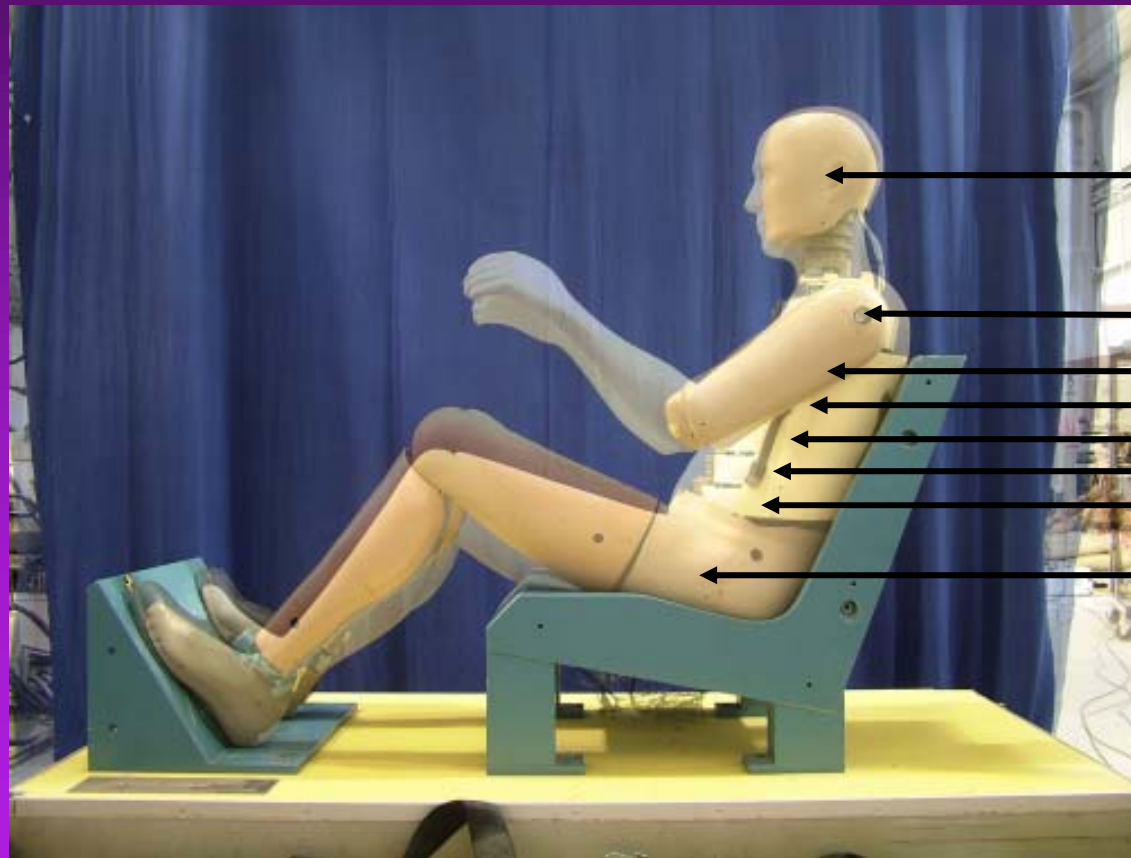
Thorax Rib 3

Abdomen Force

H-Point

NHTSA - WorldSID 50th Evaluation

- ▶ Anthropometry study
 - WorldSID versus UMTRI seating



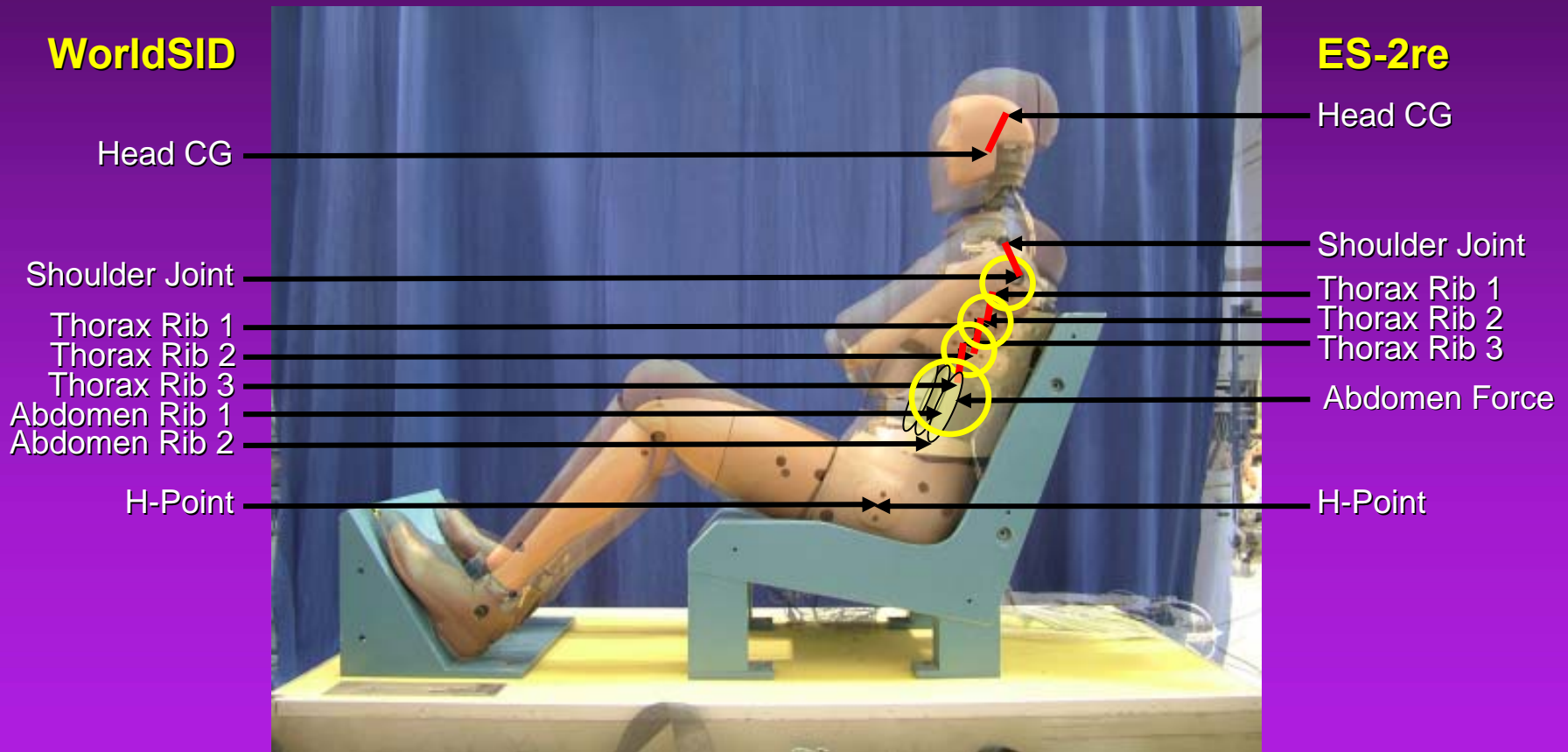
WorldSID

- Head CG
- Shoulder Joint
- Thorax Rib 1
- Thorax Rib 2
- Thorax Rib 3
- Abdomen Rib 1
- Abdomen Rib 2
- H-Point

NHTSA - WorldSID 50th Evaluation

► Anthropometry study

● WorldSID versus ES-2re in UMTRI seating



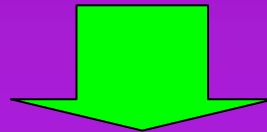
NHTSA - WorldSID 50th Evaluation

► Results of anthropometry study:

- WorldSID anthropometry based on UMTRI
- ES-2re anthropometry based on Hybrid-III

	WorldSID	ES-2re
	[mm]	[mm]
Shoulder width	480	485
Thorax width (nipple)	371	337
Pelvis width	410	355
Sitting height (neck/torso interface)	600	660
Sitting height (erect)	870	920
Leg Length	555	452

- WorldSID has a more “slouched” position



The WorldSID anthropometry is more realistic

NHTSA - WorldSID 50th Evaluation

- ▶ NHTSA full scale evaluation under FMVSS 214 test conditions
 - Pole & MDB
 - Same fleet vehicles used to evaluate the ES-2re

FMVSS 214 Pole Test

- 2004 Honda Accord
- 2005 Subaru Forester
- 2006 Toyota Sienna
- 2005 Ford 500
- 2006 VW Jetta
- 2005 Saturn Ion
- 2005 Ford Expedition
- 2005 VW Beetle (Convertible)

FMVSS 214 MDB Test

- 2005 Subaru Forester
- 2005 Ford 500
- 2006 VW Jetta
- 2005 Saturn Ion
- 2005 Honda CRV

- WorldSID IARVs proposed by WorldSID TG
- WorldSID seating procedure (Draft 1.0) provided by dummy positioning sub-committee

NHTSA - WorldSID 50th Evaluation

- ▶ **Results of NHTSA full scale evaluation**
 - **Good durability**
 - **MDB tests - no damages on WorldSID**
 - **Pole tests - minor damages reported**

MDB Test Summary

(Currently no detailed analyses available)

- All vehicles passed IARVs for both ES-2re and WorldSID
- WorldSID tests produced more marginal responses
- Differences are more pronounced in the pole testing

Pole Test Summary

(Currently no detailed analyses available)

- 5 out of 8 vehicles exceeded IARVs for both ES-2re and WorldSID

NHTSA - WorldSID 50th Evaluation

- ▶ **Results of NHTSA full scale evaluation (cont.)**
 - **Due to different anthropometry, body regions of ES-2re and WorldSID are in different locations**
 - **Different head positions produce different impact locations in pole tests.**
 - **Thorax and abdomens are aligned differently with the vehicle interior**

Test data available at NHTSA webpage:

http://www-nrd.nhtsa.dot.gov/database/nrd-11/veh_db.html

Further Activities

NHTSA:

- ▶ Preparation of documentation needed to Federalize the WorldSID 50th Male
- ▶ Injury criteria development
- ▶ Evaluation of seating procedure
- ▶ Evaluation of WorldSID 5th Female

EU:

- ▶ Request to EEVC-SC for WorldSID 50th Male evaluation according to the EEVC requirements

Further Activities

TRANSPORT CANADA:

- ▶ Comparison of WorldSID 50th Male response to ES2re response in FMVSS 214 barrier tests
- ▶ Finalization of the harmonized seating procedure for WorldSID 50th in mid of 2009
- ▶ Evaluation of multipoint sensing (RibEye) in WorldSID 50th (March 2009)
- ▶ Biofidelity evaluation of updated WorldSID 5th Female
- ▶ Evaluation of updated WorldSID 5th Female in full scale reconstruction of a pole crash.

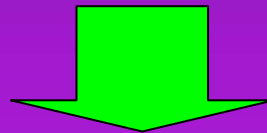
Further Activities

ISO:

- ▶ Upgrade of ISO 15830 documents will be finalized early 2009
- ▶ Development of Injury Risk Curves for WorldSID 50th Male by ISO TC22/SC12/WG6 working group (ISO TR12350)
 - **Completion expected by May 2009**

Summary

- ▶ NHTSA WorldSID 50th evaluation is completed successfully
- ▶ WorldSID 50th biofidelity is better than ES-2re in both rating schemes (NHTSA & ISO)
- ▶ Good durability, repeatability, reproducibility and usability
- ▶ WorldSID 50th anthropometry is more realistic



The WorldSID 50th male dummy is an improved side impact test dummy



Thank you !

www.worldsid.org

