WorldSID 5% Dummy Model Development in Cooperation with German Automotive Industry

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Abstract

The paper describes the methodology used to develop the PDB and FAT Dummy models. The models are used by almost all OEMs and restraint system suppliers to enhance the passive safety performance of their vehicles. Nevertheless, the PDB is still launching new projects to further enhance the predictability of the ES-2, ES-2re, BioRID-II and WorldSID models.

This paper presents the current state of a new project to develop the WorldSID 5% model. The project is still in definition phase but there are first results available of the Modell. The test database generated to build and validate the models is described as well as the performance of the current development release.

1. Introduction

- The WorldSID 50th percentile male crash test dummy was developed by a world-wide collaborative effort that was managed by the ISO WorldSID Task Force under a tri-chair representing Europe, the Americas, and Asia-Pacific.
- With an overall ISO biofidelity rating of 7.6 the WorldSID-50M offers a biofidelity improvement over other currently available side impact dummies such as the BioSID, ES-2, EuroSID-1 and USDOT-SID (EEVC WG12, 2009).
- More recently, the WorldSID 5th percentile female dummy was developed by the European FP6 project APROSYS. The design of the 5th dummy was based on the 50th design with the objective to create a family of dummies that give a consistent direction to the design of vehicle safety structures and restraint systems.
- Eggers (2009) reported that the WorldSID-5th has an overall ISO biofidelity rating of 7.5, close to the 50th. ISO TR9790 Biofidelity Rating 2009:

	WSID 5%	SID-IIs
Head	10	7.5
Neck	6.2	5.1
Shoulder	7.4	5.8
Thorax	6.9	6.6
Abdomen	8.5	7.7
Pelvis	6.5	4.3
Overall rating	7.5	6.2

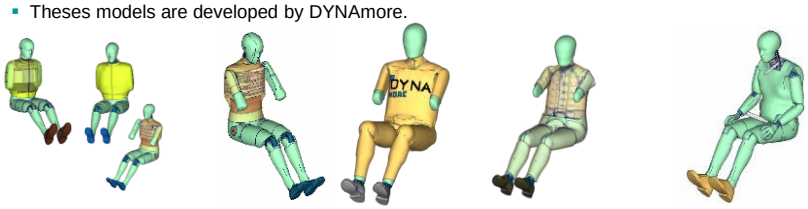
14th International LS-DYNA Users Conference, June 12th – 14th 2016

1. Introduction (FAT / PDB Dummy Models)

- FAT (German Association for Research on Automobile Technology)
- Participants of the first dummy modeling project

- PDB (Partnership for Dummy Technology and Biomechanics)

- Theses models are developed by DYNAmore.



2. Development process of FAT / PDB Models

- **Material Tests**
- Rubbers, foams, Vinyl, Nitinol (WorldSID), rib damping material (WorldSID), Neoprene (ES2), …

- Test types:
- Static tension and compression
- Dynamic tension and compression (0.001 1/s, 20 1/s,100 1/s, 400 1/s)
- For rubber-like materials additional compression tests with constrained lateral expansion

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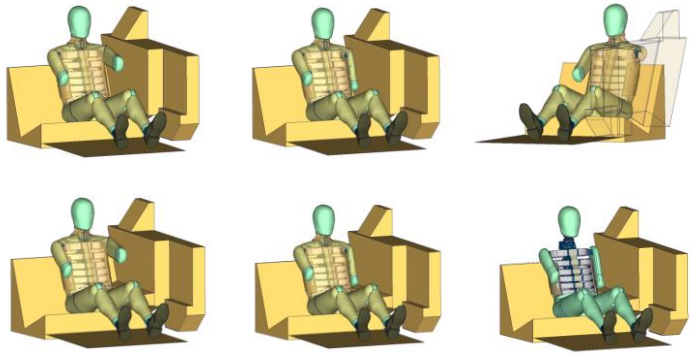
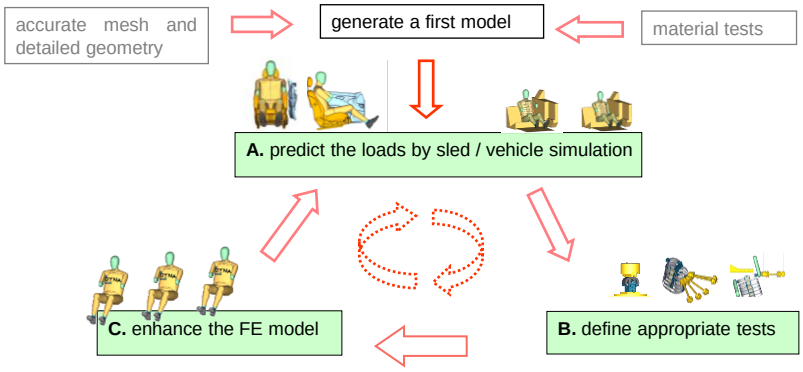
2. Development process of FAT / PDB Models

- **Sled tests on fully assembled Dummy**
- Loading similar to a crash load
- Test setup is still simple
- Investigate interaction of parts



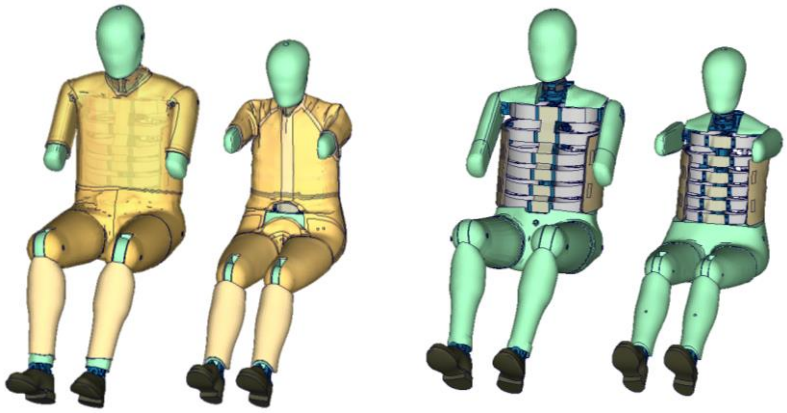
2. Development process of FAT / PDB Models

- **Methodology of Development**



3. Visual comparison of WorldSID 50% and 5%

- Left hand side WorldSID 50%
- Right hand side WorldSID 5%



4. Mass validation

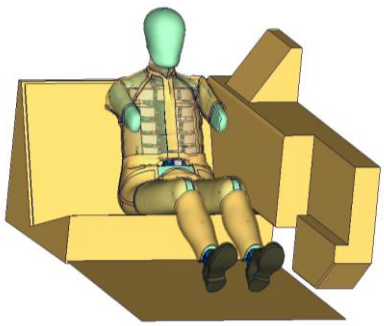
- All Body areas and single components are weighted
- The masses in the model are not adjusted bye changing the density, they are adjusted bye capturing the geometry as accurately as possible.

Component	Measured [g]	Model[g]	Difference [g]	Difference [%]
Head	3517,9	3515,4	-2,5	-0,07%
Neck	2474,5	2497,7	23,2	0,94%
Thorax	10387,9	10820	432,1	4,16%
Arms	2330,6	2462,4	131,8	5,66%
Pelvis assembly old	10482,7	10292,2	-190,5	-1,82%
Legs Left + Right	14738,6	14807,3	68,7	0,47%
Suit	1488,8	1223,1	-265,7	-17,85%
Sum	**45421**	**45618,1**	**197,1**	**0,43%**

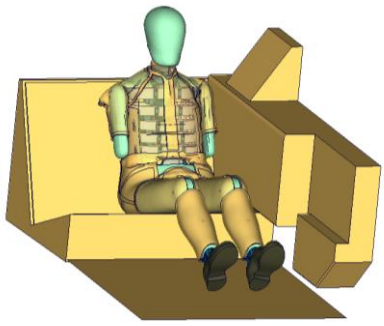
5. First results of sled tests

- PDB WorldSID 5% v0.0 alpha

Arm driver position
3.5 m/s



Arm passenger position
4.0 m/s and 6.7 m/s



6. Conclusion

- First model of PDB WorldSID is nearly finished.
- Mass validation is done and accurate
- Material Data is used from WorldSID 50% model
- No Component test are used currently for validation
- Sled results look OK for the first Model

- If the working group is finally defined, model enhancements will start like:
  - Testing new material which are not in WorldSID 50%
  - Performing needed component test
  - Updating the model on latest geometry state (side Kit)