GTR 07 phase II
Backset measurement variations
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Backset repeatability and reproducibility measurements:

Test series 1:

Backset of the same seat (same adjustments) are measured by 4 different trained technicians by using 3 different HPM and the same HRMD:

<table>
<thead>
<tr>
<th>Technician</th>
<th>HPM</th>
<th>HRMD</th>
<th>Backset [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
<td>A</td>
<td>41</td>
</tr>
<tr>
<td>B</td>
<td>A</td>
<td>A</td>
<td>42</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>A</td>
<td>43</td>
</tr>
<tr>
<td>A</td>
<td>C</td>
<td>A</td>
<td>35</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>A</td>
<td>42</td>
</tr>
<tr>
<td>B</td>
<td>C</td>
<td>A</td>
<td>34</td>
</tr>
<tr>
<td>C</td>
<td>B</td>
<td>A</td>
<td>40</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>A</td>
<td>41</td>
</tr>
<tr>
<td>D</td>
<td>B</td>
<td>A</td>
<td>43</td>
</tr>
<tr>
<td>D</td>
<td>C</td>
<td>A</td>
<td>40</td>
</tr>
</tbody>
</table>

- Backset differences of up to 9mm are measured (= HPM + technician influence)
Backset repeatability and reproducibility measurements:

Test series 2:

Backset of the same seat (same adjustments) are measured by 4 different trained technicians by using 3 different HPM and 3 different HRMD:

<table>
<thead>
<tr>
<th>Technician</th>
<th>HPM</th>
<th>HRMD</th>
<th>Backset [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>A</td>
<td>66</td>
</tr>
<tr>
<td>A</td>
<td>C</td>
<td>A</td>
<td>63</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>A</td>
<td>66</td>
</tr>
<tr>
<td>B</td>
<td>C</td>
<td>A</td>
<td>63</td>
</tr>
<tr>
<td>C</td>
<td>B</td>
<td>A</td>
<td>74</td>
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<tr>
<td>C</td>
<td>C</td>
<td>A</td>
<td>68</td>
</tr>
<tr>
<td>D</td>
<td>B</td>
<td>A</td>
<td>70</td>
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<tr>
<td>D</td>
<td>C</td>
<td>A</td>
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<tr>
<td>C</td>
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<td>B</td>
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<td>D</td>
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<td>61</td>
</tr>
<tr>
<td>C</td>
<td>D</td>
<td>B</td>
<td>63</td>
</tr>
</tbody>
</table>

- Backset differences of up to 11mm were measured with 3 different HPM and 1 HRMD
- Backset differences of up to 18mm were measured with 3 different HPM and 3 HRMD
The problem:
Significant differences in the results of backset measurements between different laboratories on the same seats!

Influence factors of measurement tool:
- Variability of SAE J826 tool
- Variability of HRMD tool
- Variability of Calibration procedures
- Variability of seat and H-point tool set-up

Labo A: Backset = 56 mm
Labo B: Backset = 74 mm
HRMD-backset measurement: 
*Influence factors: Seat and tool set-up*

**Seat adjustments differ depending on procedure:**
- seat back adjustment
- height adjustment/tilt adjustment
- head restraint adjustment

**HPM and HRMD set-up procedure may vary in:**
- Length of adjustment of legs
- Use of weights
- ....
HRMD-backset measurement:  
*Influence factors : SAE J826 (HPM)*

SAE J826 H-point measurement tool:  
- In use since decades  
- Several suppliers over time  
- Few official geometry until 2010  
- Past deviations in fabrication tolerances

SAE J826 tool geometry:  
- Official 2D geometry only since nov.2008 with large tolerances  
- Preliminary 3D data set since june 2011 without tolerances  
- GTR 7 based on 1995 version of SAE J826 (without geometry)

- Back pan width : allowed 388 +/- 2 and 395 (builts prior 1989)  
- Back pan height : not defined  
- Pan position versus H-point +/- 2mm
Tools for HRMD-measurement: Are these precise enough?

CAHRS-Whiplash-Praxis-Konferenz 20./21. Oct. 2010: Comparison of several HPM's (Lear/Audi/Faurecia/etc.)

Unterschiede bei „Weight Hanger“

a) 6 mm Unterschied der „Weight Hanger“ in X-Richtung
b) Quelle: GO-DESIGN

Weight Hanger: Difference of 6 mm in X

Interface of HPM/HRMD: 9 mm in X and more than 0.5° in angle
Tools for HRMD-measurement: 
Are these precise enough?

Overlay of different HRMD scans: 
(AUDI/LEAR/FAURECIA/AUTOLIV) 
and compared with CAD: 
X = 0,2 – 7,12 mm 
Z = 0,59 – 6,44 mm
HRMD-backset measurement:
*Influence factors : HRMD*

**Head Restraint measurement device :**
- 3D geometry : secret of ICBC (owner)
- Few 2D geometry officialized
- Scans showed large tolerances
- Imprecise interface of HRMD on SAE J826 dummy

Overlay of different HRMD’s scans:
- (AUDI/LEAR/FAURECIA/AUTOLIV)
- and compared with CAD:
  - $X = 0.2 - 7.12 \text{ mm}$
  - $Z = 0.59 - 6.44 \text{ mm}$

HRMD – Interface on SAE Dummy vary by up to 9 mm and up > 0.5° in angle
HRMD-backset measurement: Calibration procedure HPM + HRMD

- **SAE J826 calibration:**
  - HPM only calibration, but large tolerance

- **Gloria calibration:** (EuroNcap)
  - Calibration of HRMD in relationship to HPM pans only
  - Improved, but still significant tolerances as influences from HPM pans are not excluded

- **Full HRMD + HPM calibration:**
  - Calibration of HRMD
  - Calibration of HPM shells with reduced tolerances
  - Best procedure
HRMD-backset measurement: 
*Precision HPM + HRMD*

**Conclusions:**

- Test series showed differences of up to 18mm for backset measurements with 3 different HPM and 3 HRMD on the same seat.
- SAE J826 as defined today in SAE J826:1995 is not able to guarantee a sufficient precise geometry of the HPM able to be used together with the HRMD.
- HRMD geometry and tolerances must be controlled for the backset measurement.
- Only certain HPM with reduced tolerances in comparison to SAE J826 shall be used for backset measurements.
- HPM + HRMD must be calibrated together.
Proposal to improve the reproducibility of the backset:

SAE J826: Nov 2008

- Filter with reduced tolerances
- HPM able for backset measurement (reduced tolerances)
- HRMD with defined tolerances
- HRMD/HPD calibration as a whole
Proposal for a HPM compliant for backset measurement:

SAE J826 with reduced tolerances able for backset measurements:

- HPM back pan width [+/- 1mm]
- HPM cushion pan width [+/- 1mm]
- Cushion and back shell pan position versus H-point: [+/- 1mm]
- HPM back pan height [+/- 1mm]
- HRMD interface on SAE dummy
- Torso line measurement plate [0°/+0.3°]
Technical perfection, automotive passion