Japan Research Activities in the GTR-7 Phase 2 amendment

Bio RID II seating proposal #5

JASIC/Japan

Rev.4 Feb. 28-Mar. 1. 2011
Rev.2 Dec. 8. 2009
Rev.1 Nov. 6. 2009
1. Seating Condition Proposal

2. Seating Procedure Proposal based on variation study

3. Comparison between design torso angle and 25 degree fixed angle

Background of Design Torso Angle Proposal

Design torso angle is specified by typical driving posture for each type of vehicle and seating height. It is varied from 10° to 30°.

- For certain seat designs, 25° bears no relation to the real world seating position and in some cases may not even be physically achievable.
- Advise the use of the procedure specified in ECE17 Annex 3.

All other safety tests, including vehicle crash tests, are conducted with the design torso angle.

Note: data presented in HR-4-13

Note: presented in HR-6-13
1. Seating Condition Proposal

The dummy seating procedure should be modified from the IIWPG procedure as follows, as the actual seating angle is closer to the design torso angle. In addition, the dummy outputs are very sensitive to the static backset according to the simulation and test results.

① Seat torso angle: Design torso angle 25 degrees

② Backset tolerance: +/-2 mm +/- 5 mm.

③ Special adjustment in the case of smaller torso angle seat
2. Seating procedure variation effect study

JARI has conducted the following tests to confirm the effects of seating variation.

- Back set: +5mm +10mm
- H-point +5mm +10mm
- Pelvis angle: +2.5° −2.5°

Crash Pulse: Delta V 20km/h
Seat: Passive-type seat
## Seating procedure variation effect study

### Variation effect summary

<table>
<thead>
<tr>
<th>Test No.</th>
<th>HRCT</th>
<th>Hx Acc.</th>
<th>T1 Acc.</th>
<th>Upper FX</th>
<th>Upper FZ</th>
<th>Upper MY-Flx.</th>
<th>Upper MY-Ext.</th>
<th>Lower FX</th>
<th>Lower FZ</th>
<th>Lower MY-Flx.</th>
<th>Lower MY-Ext.</th>
<th>NIC</th>
<th>OC-T1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-B-01~05 (Ave.)</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>2008-B-06 (BS +5mm)</td>
<td>103.1</td>
<td>107.7</td>
<td>98.7</td>
<td>123.5</td>
<td>111.9</td>
<td>104.7</td>
<td>100.0</td>
<td>111.9</td>
<td>121.9</td>
<td>124.6</td>
<td>114.4</td>
<td>118.2</td>
<td>104.7</td>
</tr>
<tr>
<td>2008-B-07 (BS +10mm)</td>
<td>105.8</td>
<td>114.8</td>
<td>97.6</td>
<td>146.7</td>
<td>123.0</td>
<td>109.2</td>
<td>100.0</td>
<td>123.5</td>
<td>143.2</td>
<td>147.0</td>
<td>128.4</td>
<td>135.5</td>
<td>109.8</td>
</tr>
<tr>
<td>2008-B-08 (HP +5mm)</td>
<td>100.9</td>
<td>101.9</td>
<td>96.0</td>
<td>111.6</td>
<td>99.2</td>
<td>104.2</td>
<td>100.0</td>
<td>101.4</td>
<td>102.1</td>
<td>105.7</td>
<td>105.0</td>
<td>103.4</td>
<td>99.8</td>
</tr>
<tr>
<td>2008-B-09 (HP +10mm)</td>
<td>101.9</td>
<td>103.8</td>
<td>92.3</td>
<td>123.3</td>
<td>98.8</td>
<td>108.2</td>
<td>100.0</td>
<td>103.0</td>
<td>104.2</td>
<td>109.7</td>
<td>110.0</td>
<td>107.6</td>
<td>99.5</td>
</tr>
<tr>
<td>2008-B-10 (PA +2.5°)</td>
<td>97.7</td>
<td>100.2</td>
<td>89.8</td>
<td>106.5</td>
<td>101.7</td>
<td>103.3</td>
<td>100.0</td>
<td>102.7</td>
<td>105.4</td>
<td>103.2</td>
<td>102.8</td>
<td>89.6</td>
<td>96.3</td>
</tr>
<tr>
<td>2008-B-11 (PA -2.5°)</td>
<td>103.7</td>
<td>102.7</td>
<td>110.7</td>
<td>100.7</td>
<td>100.4</td>
<td>95.6</td>
<td>100.0</td>
<td>98.2</td>
<td>97.2</td>
<td>107.2</td>
<td>102.3</td>
<td>117.7</td>
<td>106.9</td>
</tr>
</tbody>
</table>

Unit: % ±5 ±10 ±20 ±21~

### Conclusion
- Back set variation produces the greatest effect on all indicators.
- H-point variation is the second effect on all indicators.
3. Comparison between design torso angle and 25 degree fixed angle

Evaluation Method
Compare with the same seat evaluation indicator variation between JNCAP test with design torso angle and IIHS test with 25 degree fixed torso angle.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>target value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIC</td>
<td>22</td>
</tr>
<tr>
<td>Upper Fx</td>
<td>620</td>
</tr>
<tr>
<td>Upper Fz</td>
<td>950</td>
</tr>
<tr>
<td>Upper My(Flx.)</td>
<td>32</td>
</tr>
<tr>
<td>Upper My(Ext.)</td>
<td>32</td>
</tr>
<tr>
<td>Lower Fx</td>
<td>620</td>
</tr>
<tr>
<td>Lower Fz</td>
<td>1075</td>
</tr>
<tr>
<td>Lower My(Flx.)</td>
<td>32</td>
</tr>
<tr>
<td>Lower My(Ext.)</td>
<td>32</td>
</tr>
</tbody>
</table>

Sled pulse
Delta-V: 16 [km/h]  

Sled pulse
Delta-V: 17.6 [km/h]
3. Comparison between design torso angle and 25 degree fixed angle

Additional Sled Test
Comparison of three different torso angles for two different seats.

<table>
<thead>
<tr>
<th>Seat type</th>
<th>Torso angle (degree)</th>
<th>Backset (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-01</td>
<td>21.3</td>
<td>73</td>
</tr>
<tr>
<td>A-02</td>
<td>22.2</td>
<td>86</td>
</tr>
<tr>
<td>A-03</td>
<td>24.1</td>
<td>94</td>
</tr>
<tr>
<td>C-01</td>
<td>19.5</td>
<td>82</td>
</tr>
<tr>
<td>C-02</td>
<td>20.9</td>
<td>85</td>
</tr>
<tr>
<td>C-03</td>
<td>23.0</td>
<td>84</td>
</tr>
</tbody>
</table>

Sled pulse
Delta-V: 16 [km/h]
3. Comparison between design torso angle and 25 degree fixed angle

No clear tendency was seen in evaluation indicators between 25° fixed angle and standard torso angle in seats with a design torso angle of 20° or more.

\[ 203 \times \sin 1 = -3.5 \text{mm} \]
3. Comparison between design torso angle and 25 degree fixed angle

No clear tendency was seen in evaluation indicators between 25° fixed angle and standard torso angle in seats with a design torso angle of 20° or more.
3. Comparison between design torso angle and 25 degree fixed angle

No clear tendency was seen in evaluation indicators between 25° fixed angle and standard torso angle in seats with a design torso angle of 20° or more.
SUMMARY

◆ To evaluate dummy seating in the actual driving position as well as in the same position as in other crash forms, the standard design torso angle should be used.

◆ No clear different was seen in the effect on the dynamic evaluation between standard design torso angle (20° or more) and 25° fixed angle.
The front seat torso angle is upright (less than 20°) in 45% of vehicles on the market. Therefore, it is difficult to appropriately evaluate all the seats by dynamic testing unless the upright dummy is established.
4. Smaller Design Torso Angle seat seating trial

**Standard tool**

- 29.5 ±1.5
- 156 ±5

**Upright tool**

- 37±0.5
- 609±5
- 14.5
- 52-53 (-15-16)
- 648 (+39)
- 68 (-88)

T2 angle of Upright tool is about 15 degree greater than standard tool.
Spine Pin and Point Measurement Result

**Without Jacket**

- Standard tool
- Upright tool

**With Jacket**

- Standard tool
- Upright tool
- Large forward inclination
- Jacket attachment bolts restriction
Seating Trial Result

- Dummy head angle and backset are improved with upright tool.
- In the case of about 14 degree torso angle, head can maintain laterally level, however, backset is little bit smaller than target, 112mm.

**Standard tool**
with 10 degree torso angle

**Upright tool**
with 10 degree torso angle

**Upright tool**
with about 14 degree torso angle condition
SUMMARY of Smaller Design Torso Angle seat seating trial

◆ The spine and jacket are able to install without any conflict.

◆ T2 angle of Upright tool is about 15 degree greater than standard tool

◆ Large forward inclination is occurred due to the jacket attachment bolts restriction

◆ Dummy head angle and backset is improved for 10 degree torso angle seat with upright tool, However, head angle is
 Dummy head angle and backset is improved for 10 degree torso angle seat with upright tool, However, head angle is still tilted due to jacket restriction. Therefore, this tool introduction was proposed.

In Japan, the standard design torso angle is upright (less than 20°) in about half (45%) of vehicles on the market; it is difficult to evaluate them only by dynamic testing, and the static backset option is necessary.
Thank you for your attention!