Current Injury Criteria ECE-R 94
Comparison with US NCAP

Thorsten Adolph

IWG Frontal Impact
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Federal Highway Research Institute
Outline

Objective
- Comparison of existing test data from the HIII 5\textsuperscript{th} female Dummy in frontal crash tests (FWRB)

Data base
- NHTSA website (tests from 2011 to 2014)
- Mainly US NCAP tests with 56 km/h against rigid wall, 100\% overlap
- Dummy: front seat passenger, 5\textsuperscript{th} female Dummy HIII

2014 Kia Forte          2013 Smart electric drive  2014 Dodge Durano
2014 Kia Sorento       2014 Chevy Silverado     2011 Toyota Camry
2014 Subaru Forester   2014 Nissan Versa        2012 VW Beetle
## Occupants Protection

<table>
<thead>
<tr>
<th></th>
<th>HPC</th>
<th>1000</th>
<th>1000</th>
<th>1000</th>
<th>1000</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>a Head 3ms</td>
<td>80g</td>
<td>80g</td>
<td>80g</td>
<td>80g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Neck tension</td>
<td>1.1 kN (60ms)</td>
<td>2.9 kN (35ms)</td>
<td>3.3 kN (0ms)</td>
<td>1.1 kN (60ms)</td>
<td>2.9 kN (35ms)</td>
<td>3.3 kN (0ms)</td>
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<tr>
<td>4</td>
<td>Neck shear</td>
<td>1.1 kN (&gt;45ms)</td>
<td>1.5 kN (25-35ms)</td>
<td>3.1 kN (0ms)</td>
<td>1.1 kN (&gt;45ms)</td>
<td>1.5 kN (25-35ms)</td>
<td>3.1 kN (0ms)</td>
</tr>
<tr>
<td>5</td>
<td>Neck Moment- ext.</td>
<td>57 Nm</td>
<td>57 Nm</td>
<td>57 Nm</td>
<td>57 Nm</td>
<td>57 Nm</td>
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<tr>
<td>6</td>
<td>ThCC</td>
<td>42 mm</td>
<td>42 mm</td>
<td>42 mm</td>
<td>34 mm - 42 mm</td>
<td>42 mm</td>
<td></td>
</tr>
<tr>
<td>6a</td>
<td>aTh 3ms</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Rod Pot</td>
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<tr>
<td>7</td>
<td>V*C</td>
<td>1.0 m/s</td>
<td>1.0 m/s</td>
<td>1.0 m/s</td>
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<tr>
<td>8</td>
<td>FCC</td>
<td>7.58 kN (10ms)</td>
<td>9.07 kN (0ms)</td>
<td>7.58 kN (10ms)</td>
<td>9.07 kN (0ms)</td>
<td>9.07 kN</td>
<td>7 kN (0ms)</td>
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<td>9</td>
<td>TCFC</td>
<td>8kN</td>
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<td>10</td>
<td>Kneeslider</td>
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<td>11</td>
<td>Tl</td>
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<td>1.3</td>
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</tbody>
</table>
Proposal for IARVs from 22nd IWG FI Meeting

NIC* tension (upper): 2,01 kN @ 0ms  
(scaled based on Mertz et al. 2003) 1,83 kN @ 28ms  
0,7 kN @ ≥ 48ms

NIC* Shear (peak): 1,95 kN  
(Mertz et al. 2003)

M_y(-)*: 29 Nm  
(scaled based on Mertz et al. 2003)

HPC36: 1000 (ECE-R 94)  
HPC_{15}: 700 (Eppinger et al. 2000)  
a_{3ms}: 80 g (ECE R-94)

ThCC: 34 mm  
(scaled to chest depth, Mertz 2003)

VC*: 1.0 m/s (ECE R-94)

Thorax Acc Peak: 60g  
(Mertz et al. 2003)

FFC: 6,16 kN @ 0 ms  
(Mertz et al. 2003) 5,13 kN @ ≥ 9 ms

Knee Slider: 12mm (Mertz et al. 2003)

TI: 1 (M_{C})_R 114 Nm and (F_{C})_Z 22,9N  
(Mertz et al. 2003)

TCFC: 5,1 kN  
(Tibia Compr., F_{Z}; Mertz et al. 2003)
Comparison of HIC$_{15}$ values

NHTSA uses HIC$_{15}$ with 700 which is almost comparable to HIC$_{36}$ with 1000.
Comparison of Neck Tension Values

54th GRSP Meeting: 2,9 kN

NIC tension (scaled based on Mertz 2003)
2,01 kN @ 0ms
1,83 kN @ 28ms
0,7 kN @ ≥ 48ms
Comparison of Chest Deflection Values

54th GRSP Meeting: 42mm
Scaled on chest depth: 34mm

0 5 10 15 20 25 30 35 40 45 50


Min 9mm  Max 25mm
Comparison of Femur Forces

54th GRSP Meeting: 7 kN

FFC (Mertz et al. 2003): 6.16 kN @ 0 ms

5.13 kN @ ≥ 9 ms
Conclusions

• Current vehicles in US NCAP with 56 km/h are well below the proposed limits from the 54th GRSP

• Scaled values shall be used for the 5th Dummy, in particular 34mm for the chest deflection
Current Injury Criteria ECE-R 94
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Thank you for your attention

Dr. Thorsten Adolph
Section “Passive Safety & Biomechanics”
adolph@bast.de

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Conclusions

- Current vehicles in US NCAP with 56 km/h are well below the proposed limits from the 54th GRSP

- Scaled values shall be used for the 5th Dummy
  - NIC tension
  - NIC shear
  - Neck moment
  - Thorax deflection
  - Femur forces