WorldSID test results

Autoliv Research

Cecilia Sunnevång
2011-06-08
Overview

- WSID 5% rear-seat sled tests
- WSID 5% & 50% front-seat sled test
- Hardware issues
- High speed Car-to-Car intersection crash
- UVa / Autoliv WSID-PMHS impactor tests
Rear-Seat Sled Tests
-setup

- Sled rig
  - Half body in white
    - from a compact sized car
    - Vehicle door trim, lower c-trim and rear seat
  - Lincap vehicle pulse
    - From NHTSA test

- Dummy
  - SIDIs, WorldSID5%
Rear-Seat - Sled test

No Side Airbag
Rear-Seat - Sled test

Standard Thorax/Pelvis Side Airbag
Rear-Seat - Sled test

Thorax Side Airbag
Rear-Seat - Sled test

- **SIDIIs - No bag**
  - Head acc
  - Pelvis Acc

- **WSID5% - No bag**
  - Head acc
  - Pelvis Acc

- **SIDIIs - Standard Thorax/Pelvis bag**
  - Head acc
  - Pelvis Acc

- **WSID5% - Standard Thorax/Pelvis bag**
  - Head acc
  - Pelvis Acc

- **SIDIIs - Thorax bag**
  - Head acc
  - Pelvis Acc

- **WSID5% - Thorax bag**
  - Head acc
  - Pelvis Acc
Rear-Seat - Sled test

- SIDIIs - No bag
- WSID5% - No bag

- SIDIIs - Standard Thorax/Pelvis bag
- WSID5% - Standard Thorax/Pelvis bag

- SIDIIs - Thorax bag
- WSID5% - Thorax bag
Conclusions

- Different kinematic behavior for WSID 5% compared to SIDIIs
- Difference in deflection measurement for WSID 5% vs SIDIIs
- Need of reliable and acceptable risk functions
  - Dummy comparison
  - Front- and rear seat comparison
- More measurements in pelvis
Front-Seat Sled Tests
-setup

- Sled rig
  - Intruding door side
    - Generic padding as door panel
    - Front seat
  - Generic EuroNCAP pulse

- Dummy
  - WorldSID 50%, WorldSID 5%
Front-Seat - Sled test

EuroNCAP generic pulse-Thorax Side Airbag
Dummy measurements – WSID 50% & 5%
Front-Seat Sled Test – WSID 50 & 5%-ile

WSID 50% - Head
WSID 50% - Pelvis

WSID 50% - Shoulder rib
WSID 50% - Rib 1
WSID 50% - Rib 2
WSID 50% - Rib 3
WSID 50% - Rib 4
WSID 50% - Rib 5

WSID 5% - Head
WSID 5% - Pelvis

WSID 5% - Shoulder rib
WSID 5% - Rib 1
WSID 5% - Rib 2
WSID 5% - Rib 3
WSID 5% - Rib 4
WSID 5% - Rib 5

WSID 50% - Pubic
WSID 50% - Sacro Iliac LH

WSID 5% - Pelvis

Chest Displacement [mm]
Pubic force [kN]
Hardware issues

- WSID 5&50% Pelvis measurement lost in many tests
  - Pubic load cell
  - Sacro Illiac load cell

- Neck torn on WSID 5%

- WSID 50% Range of motion for Shoulder IR-TRACC
  - Broken in 214 Pole test
Improved side impact protection in the traffic of the future – car to car full vehicle crashes with WorldSID 50%
## Full-scale tests

<table>
<thead>
<tr>
<th>Bullet &amp; Target</th>
<th>Impact speed</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2009</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid size vs. Mid size</td>
<td>55 km/h</td>
<td></td>
</tr>
<tr>
<td>Mid size vs. Mid size</td>
<td>70 km/h</td>
<td>Influence of Impact speed</td>
</tr>
<tr>
<td>Mid size vs. Mid size</td>
<td>80 km/h</td>
<td></td>
</tr>
<tr>
<td>Mid size vs. Small car</td>
<td>55 km/h</td>
<td>Influence of mass ratio</td>
</tr>
<tr>
<td><strong>2010</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Older vs. Older</td>
<td>55 km/h</td>
<td>Relation to real life data</td>
</tr>
<tr>
<td>Older vs. Older</td>
<td>70 km/h</td>
<td></td>
</tr>
<tr>
<td>Plattform SUV vs. Mid size</td>
<td>65 km/h</td>
<td>Influence of mass and compatibility</td>
</tr>
<tr>
<td>Frame SUV vs. Mid size</td>
<td>65 km/h</td>
<td></td>
</tr>
<tr>
<td>AE-MDB vs. Mid size</td>
<td>60 km/h</td>
<td>Potential future load case</td>
</tr>
<tr>
<td>Mid size versus Mid size</td>
<td>70 km/h / 30 km/h</td>
<td>Representative intersection crash</td>
</tr>
</tbody>
</table>
Intersection crash
Intersection crash

- AIS3+ Injury risks (Petitjean et. al 2009, survival method)

Shoulder 1.5 %
Thorax / Abdomen 1.0 %
Pelvis 24.0 %
Project Highlights

• WorldSID improved tool for side impact evaluation
• Good structural integrity of all target vehicles
• SAB presence reduce the occupant thoracic injury risk
• Thorax Injury Risks < 10% for a 45 year old occupant

Additionally...
Future focus for side impact protection

1. Pelvis loading
2. Occupant-to-Occupant Interaction
3. Rear-Seat
4. Senior occupants
WorldSID related Conclusions

WorldSID – good tool for evaluating overall side impact occupant protection.

- Spine kinematic
- Bi-lateral loading
- Ability to measure low and high crash severities
- Different response from different side airbag concepts

Specific points of interest:

- Rib rotation
- Shoulder kinematics
- Pelvis measurement and injury risk