Side Impact Test Results using WS & ES2 in AE-MDB

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Korea Automobile Testing & Research Institute

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Program Overview

• Assessment of WorldSID dummy in vehicle crash environment.
  • Test conditions
    - AE-MDB 1,300kg, 50km/h
  • Comparison of WorldSID 50th and ES2 dummies
    - for Compact & Midsized vehicles (4 times)
    - Injury parameters, Rib deflections etc.

Note: Test was conducted by a part of KATRI & HMC WorldSID & PSI Joint Research program
Test Setup

Test Condition & Matrix

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>GVW(kg)</th>
<th>Dummy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact vehicle</td>
<td>1,042</td>
<td>ES2</td>
</tr>
<tr>
<td></td>
<td>1,039</td>
<td>WS 50th</td>
</tr>
<tr>
<td>Midsized vehicle</td>
<td>1,528</td>
<td>ES2</td>
</tr>
<tr>
<td></td>
<td>1,533</td>
<td>WS 50th</td>
</tr>
</tbody>
</table>

AE-MDB
- Weight : 1,300kg
- Honeycomb v3.9

EuroNCAP test protocol

50km/h
Test Setup

Compact vehicle
Test Setup

Midsized vehicle
Test Setup

Compact vehicle
Test Setup

Compact vehicle
Test Setup

Midsized vehicle
Test Setup

Midsized vehicle
Tests

Compact vehicle
Tests

Midsized vehicle
Tests

Compact vehicle

[Images of compact vehicle interiors showing dummy figures inside, likely demonstrating test scenarios.]
Midsized vehicle
## Test results

<table>
<thead>
<tr>
<th></th>
<th>Compact vehicle</th>
<th>Midsized vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ES2</td>
<td>WS 50&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Head</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIC 36</td>
<td>-</td>
<td>84.03</td>
</tr>
<tr>
<td>Peak resultant Acceleration</td>
<td>g</td>
<td>37.33</td>
</tr>
<tr>
<td></td>
<td>g</td>
<td>29</td>
</tr>
<tr>
<td><strong>Shoulder</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoulder Rib Deflection(1)</td>
<td>mm</td>
<td>-</td>
</tr>
<tr>
<td><strong>Thorax</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Rib Deflection(2)</td>
<td>mm</td>
<td>32.4</td>
</tr>
<tr>
<td>Middle Rib Deflection(3)</td>
<td>mm</td>
<td>22.1</td>
</tr>
<tr>
<td>Lower Rib Deflection(4)</td>
<td>mm</td>
<td>22.5</td>
</tr>
<tr>
<td><strong>Pelvis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdomen Rib1 Deflection(5)</td>
<td>mm</td>
<td>-</td>
</tr>
<tr>
<td>Abdomen Rib2 Deflection(6)</td>
<td>mm</td>
<td>-</td>
</tr>
<tr>
<td>Pubic Symphysis Force(Fy)</td>
<td>kN</td>
<td>2.11</td>
</tr>
</tbody>
</table>
Test results

Head results for Compact and midsized vehicle tests

- ES2_C
- WS_C
- ES2_M
- WS_M

- HIC 36
- Peak resultant Acceleration
- 3ms exceedence
Thorax results for compact and midsized vehicle tests

- Upper Rib Deflection (2)
- Middle Rib Deflection (3)
- Lower Rib Deflection (4)
Test results

Pelvis results for compact and midsized vehicle tests

Pubic Symphysis Force ($F_y$)

- ES2_C
- WS_C
- ES2_M
- WS_M

Graph showing the pubic symphysis force ($F_y$) for different vehicle types.
## Test result Analysis

<table>
<thead>
<tr>
<th></th>
<th>Compact vehicle</th>
<th>Midsized vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ES2</td>
<td>WS 50&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Shoulder Rib Deflection(1)</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>32.4</td>
<td>20.12</td>
</tr>
<tr>
<td>Upper Rib Deflection(2)</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>22.1</td>
<td>7.09</td>
</tr>
<tr>
<td>Middle Rib Deflection(3)</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>22.5</td>
<td>7.57</td>
</tr>
<tr>
<td>Lower Rib Deflection(4)</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>22.5</td>
<td>11.89</td>
</tr>
</tbody>
</table>

### Matching position for Rib

<table>
<thead>
<tr>
<th></th>
<th>Compact vehicle</th>
<th>Midsized vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ES2</td>
<td>WS 50&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Upper Rib</td>
<td>Shoulder Rib</td>
<td>mm</td>
</tr>
<tr>
<td>Middle Rib</td>
<td>Upper Rib</td>
<td>32.4</td>
</tr>
<tr>
<td>Lower Rib</td>
<td>Middle Rib</td>
<td>22.1</td>
</tr>
</tbody>
</table>

*Source: Dynamic side impact testing with the 50<sup>th</sup> percentile male WorldSID compared to the ES2re, Allison E. Louden (NHTSA)*

**Conversion**
Test result Analysis

Before Conversion

After Conversion

Except this

Side Pole Test
Summary

- Thoracic Injury responses (e.g. location of maximum Rib deflections) of WorldSID and ES2 dummy are not consistent with each crash test.
  - This seems due to the differences of seating position & posture, dummy heights etc

- After aligned with heights of rib locations, the location of maximum rib deflection may consistent with two WS & ES2 dummies
  - It is needed to collect more crash test data and research to verify this results
Thank you for your attention!

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