IHRA/PS Decisions for the IHRA/PS Legform Test Procedures

IHRA/PS Working Group

Physical Properties

- Physical properties are based on 50th percentile of male

<table>
<thead>
<tr>
<th>Physical Properties</th>
<th>IHRA/PS/119R2</th>
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<tbody>
<tr>
<td><strong>Length</strong></td>
<td></td>
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<tr>
<td>1) Leg length between the bottom and the knee joint center (mm)</td>
<td>493 +/- 5</td>
</tr>
<tr>
<td>2) Thigh length between the knee joint center and the top (mm)</td>
<td>428 +/- 5</td>
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<tr>
<td><strong>Center of gravity</strong></td>
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<tr>
<td>1) Center of gravity of leg from the knee joint center</td>
<td>233 +/- 10</td>
</tr>
<tr>
<td>2) Center of gravity of thigh from the knee joint center (mm)</td>
<td>218 +/- 10</td>
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<tr>
<td><strong>Mass</strong></td>
<td></td>
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<tr>
<td>1) Total leg form impactor mass (kg)</td>
<td>13.4 +/- 0.1</td>
</tr>
<tr>
<td>2) Leg mass including skin and foam (kg)</td>
<td>4.8 +/- 0.1</td>
</tr>
<tr>
<td>3) Thigh mass including skin and foam (kg)</td>
<td>8.6 +/- 0.1</td>
</tr>
<tr>
<td><strong>Moment of inertia</strong></td>
<td></td>
</tr>
<tr>
<td>1) Moment of inertia around y axis of leg (kg-m^2)</td>
<td>0.120 +/- 0.001</td>
</tr>
<tr>
<td>2) Moment of inertia around y axis of thigh (kg-m^2)</td>
<td>0.127 +/- 0.001</td>
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</tbody>
</table>
Test Method

- The impact height for the legform impactor was decided tentatively 25 mm above the ground reference level.

Response Corridor for Leg

- UVA Dynamic Leg bending test corridor is adapted.
Response Corridor for Thigh

- UVA Dynamic Thigh bending test corridor is adapted.

Thigh Bending Corridor

Response Corridor for Knee (1)

- UVA Dynamic Knee bending test corridor is adapted.
- Muscle effect will be considered when the effect is clear.

Knee Bending Corridor
Response Corridor for Knee (2)

- Hanover Dynamic Knee bending test corridor is adapted.

Impact force

- V=20km/h

Bending angle

- V=40km/h

PMHS corridor (avg. +/- 1SD, n=5)

- Impact force

- Bending angle

PMHS corridor (avg. +/- 1SD, n=10)

* obtained from target marks on the long bone

Response Corridor for Knee (3)

- Hanover Dynamic Knee shearing test corridor is adapted.

Impact force

- V=20km/h

Shearing displacement

- V=40km/h

PMHS corridor (avg. +/- 1SD, n=5)

- Impact force

- Shearing displacement

PMHS corridor (avg. +/- 1SD, n=10)

* obtained from target marks on the long bone
**Impactor Evaluation Method**

- Bio-Rating Method of Maltese M. R. (NHTSA) is adapted.

**Dummy-to-Human Comparison**

- Human surrogate and dummy response signals are overlayed.
- The dummy response (D), surrogate mean (○), and standard deviation (SD) are then combined to quantify (R) how well the dummy matches the cadaver.

**Injury Risk Curve for Leg**

- UVA Injury Risk Curve for Leg is adapted.

**Injury Risk Curve for Mid-Leg**
UVA Injury Risk Curve for Knee is adapted, and decide to adapt the injury definition B for IHRA/PS. However, the UVA 2D knee bending conditions may be more severe than those of 3-D knee bending. Acceptance level of knee bending angle may be much higher in 3-D condition.

Limitations
The current IHRA/PS legform test procedure should apply to vehicles providing an initial contact point to the legform impactor at 513mm above the ground or less (i.e. at knee level or below impact).

New work items
Develop an IHRA/PS legform test method for vehicles providing an initial contact point to the legform impactor over 513 mm above the ground (i.e. at thigh impact) considering upper body mass effects, etc.
Thank you for your attention.