Purpose of US Testing

★ Understand impact of draft GTR in terms of benefits in the US and costs for the current US fleet.
★ Understand the effect of shape on feasibility
★ Gather data to determine feasibility of extending draft GTR to cover all US light vehicles fleet (4500 kg), or whether draft GTR should only apply to vehicles of 3500 kg or 2500 kg.
★ Gather data for both the head and leg requirements in draft GTR.
Head Test Overview

★ Purpose:
- Provide data on current level of head protection for GTR benefits estimate
- Focus on larger vehicles in US fleet
- Focus on vehicles with a range of front end shapes, based on bonnet leading edge location.

★ Methods:
- Head impacts per GTR procedures (35 km/h)
- 8 Hard/Soft/Typical points
- Estimated 1/3 relaxation zone to identify probable “passing” points/vehicles.
  - <= 1700 HIC in relaxation zone (1/3 test zone)
  - <= 1000 HIC everywhere else
<table>
<thead>
<tr>
<th>Test vehicles</th>
<th>GVM (kg)</th>
<th>Bonnet Leading Edge WAD (mm)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002 Jeep Wrangler</td>
<td>2019</td>
<td>916</td>
</tr>
<tr>
<td>2005 Honda CR-V</td>
<td>2020</td>
<td>880</td>
</tr>
<tr>
<td>2006 Volkswagen Passat</td>
<td>2020</td>
<td>840</td>
</tr>
<tr>
<td>2006 Toyota Tacoma</td>
<td>2063</td>
<td>992</td>
</tr>
<tr>
<td>2003 Toyota 4Runner</td>
<td>2063</td>
<td>1030</td>
</tr>
<tr>
<td>1999 Dodge Dakota</td>
<td>2200</td>
<td>895</td>
</tr>
<tr>
<td>2003 Ford Crown Victoria</td>
<td>2632</td>
<td>804</td>
</tr>
<tr>
<td>2006 Dodge Durango</td>
<td>2903</td>
<td>1088</td>
</tr>
<tr>
<td>2003 Hummer H2</td>
<td>3901</td>
<td>1172</td>
</tr>
<tr>
<td>2003 Ford E350</td>
<td>4127</td>
<td>1162</td>
</tr>
<tr>
<td>2005 Chevrolet Silverado</td>
<td>4173</td>
<td>1210</td>
</tr>
</tbody>
</table>
Vehicles with No Failures

CR-V
Max. BLE >1000 mm

Passat
835 mm > BLE < 1000 mm

Silverado
BLE > 1000 mm
Vehicles with a Failing Impact in Estimated Relaxation Zone

Tacoma
Max. BLE>1000 mm

Durango
BLE>1000 mm

Crown Victoria
835 mm< Max. BLE<1000 mm
Multiple Failing Impacts in Estimated Relaxation Zone

Wrangler
Max. BLE>1000 mm

Dakota
835mm<BLE<1000 mm

4Runner
BLE>1000 mm
Vehicles with Multiple Failing Impacts in Relaxation Zone and outside of Relaxation Zone
Solutions in Challenging Areas: Hinge

Jeep Wrangler – HIC 4302

VW Passat – HIC 1302

Ford E350 – HIC 3993

Crush space over hinge

Low-profile deformable hinge

NHTSA
www.nhtsa.gov
Solutions in Problem Areas: Cowl

Ford E350 – HIC 2448

Dodge Durango – HIC 981
Preliminary Head Impact Benefits & Costs

★ Preliminary benefits from Head Impact Test
  – Up to 2500 kg: 4-5 lives may be saved
  – 2500-3500 kg range: 49-74 lives may be saved
  – 3500-4500 kg range: 8-13 lives may be saved

★ Preliminary costs per lives saved
  (millions of US $2006)
  – Up to 2500 kg: 24.1 - 34.0
  – 2500-3500 kg range: 2.9 – 4.3
  – 3500-4500 kg range: 1.8 - 3.0
Head Testing Observations

★ No apparent reason to limit scope of GTR below 4500 kg.
  – The heaviest vehicle in our test program currently meets all head impact requirements in the draft GTR, while the lightest vehicle in the test program requires some redesign.
  – Technical consensus is that the vehicle shape, NOT the mass, is the most important.

★ The test procedure is feasible and the requirements are cost beneficial for all vehicles up to 4500 kg.

★ Few vehicles will require major re-design, but most vehicles will require some re-design. Adequate lead time must be provided to make these changes.

★ Effective countermeasures exist for challenges identified:
  – For all problem areas at least one vehicle performed well.
Lower Leg Test Overview

★ Testing 13 vehicles for compliance with the draft GTR lower leg requirements.
  – Will also analyze data from 5 previously tested vehicles, discussed in ESV paper 05-194.

★ Purpose
  – Provide data on current level of leg protection for the GTR benefits estimate
  – Focus on larger vehicles in US fleet

★ Methods
  – Lower Leg impacts per GTR procedures using the TRL legform (40 km/h)
  – 5 points per vehicle tested

★ Testing completed for discussion at June WP.29 session.
## Lower Leg Impact Testing

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>LBRL Min. Height (mm)</td>
<td>200</td>
<td>420</td>
<td>410</td>
<td>378</td>
<td>460</td>
<td>451</td>
<td>482</td>
<td>219</td>
<td>TBD</td>
<td>418</td>
<td>342</td>
<td>405</td>
<td>348</td>
</tr>
<tr>
<td>LBRL Max. Height (mm)</td>
<td>218</td>
<td>505</td>
<td>415</td>
<td>378</td>
<td>469</td>
<td>481</td>
<td>502</td>
<td>230</td>
<td>TBD</td>
<td>540</td>
<td>342</td>
<td>452</td>
<td>408</td>
</tr>
</tbody>
</table>

### GTR Test Rules

- **LBRL < 425 mm**: lower leg test required
- **425 mm ≤ LBRL < 500 mm**: manufacturer’s choice of lower or upper leg test
- **LBRL ≥ 500 mm**: upper leg test required