Report
GRB ad hoc Working Group
ASEP

by the Chairman of the ASEP WG
GRB 49; February 2009
Reminder: why ASEP

- Annex 3 covers the part of the engine map with lower revs
- Decision made to have Additional Sound Emission Provisions to cover a wider part of the engine map (higher revs).
Products to deliver:

A proposal to GRB for the text (test method, data processing to test result, limits and control range) of annex 10,

and proposals for necessary changes in the main body.
Meetings:

1. Amsterdam 2005 November
2. The Hague 2006 January
3. Geneva 2006 February
   3a-d Task Force 2006 Feb-Aug
4. Geneva 2006 September
5. The Hague 2006 November
6. Geneva 2007 February
7. The Hague 2007 May
8. The Hague 2007 October
9. Ann Arbor USA 2008 January
10. Geneva 2008 February
11. Tokyo 2008 June
12. Geneva 2008 September
13. Paris 2008 November
   13a. Expert group Paris 2008 December
Why so long?

Differences with Annex 3:

1. Acceptance

2. New Concept (point $\rightarrow$ range)

3. Limitation discussion
What did we accomplish:

- System
- Legal wording
- Understanding main issue
System: how it works
step 1: anchor point

Anchor point in gear i comes from Annex 3 \( (L_{wot,i}, n_{BB,i}) \)
System: how it works
step 2: ASEP measurements

4 additional measurements in gear i within boundaries
System: how it works
step 3: construction of slope

Calculate slope through measurements
Slope is maximized to X dB/1000 rpm; X determines stringency (to be agreed on)
System: how it works
step 4: add margin

Margin = \text{Limit}_{A3} - \text{L}_{urban,A3} \quad \text{(bigger for silent vehicles)}
System: how it works
step 5: limit line

Limit = anchor point + margin + Y + slope
Y determines stringency (to be agreed on)
System: how it works
step 6: compare measurements to limit

Every measurement from step 2 is checked against limit
System: how it works
step 7: repeat in other gears

• Other gears than gear i are corrected for different tyre noise contribution
• In principle all gears and modes have to fulfill ASEP, however
  – Gears higher than i+1 may be exempted
  – Gear 1 likely to be skipped due to engine speed overrun within test track
  – In practice mostly only gear 2 and 3
Legal wording

See informal document no 3

Agreement on many issues

Some technical issues to be dealt with (like CVT’s)
Main Issue

It’s all about

STRINGENCY
“the present proposal will result in a very undesirable situation: compared to the R51.02 regulation that is currently in use and also is based on an acceleration test, the OICA proposal will result in an extra driveline noise allowance for most vehicles, which can reach up to 10 dB with an average of about 3 dB.”
Expert Group

Looked to it in details

Came up with analyses
Stringency:

Two aspects

- limit
- area of control (boundary conditions)
Factors influencing stringency

• A table has been made summing up the most important factors. In rank order
  – Limit annex 3
  – Boundary conditions annex 3
  – Limit of annex 10 (anchor point, slope and margin)
  – Boundary conditions annex 10

• So: annex 3 has more influence on stringency than annex 10 itself
Limit A3 $\rightarrow$ Limit A10

Multiplier effect (kp factor): up to 1.7

1 dB lack of stringency in Annex 3 means: Up to 1.7 dB less stringent in Annex 10

PM: higher PMR $\rightarrow$ less stringent limit
Boundary Condition Acceleration
Annex 3

• Boundary condition $a_{\text{max}} = 2 \text{ m/s}^2$ forces vehicles to higher gear/lower revs

• Means: anchor point annex 10 is going left

• Means: Annex 10 limitation weaker

• For Annex 3 little effect due to $k_p$ compensation
Anchor point Annex 10 to the left

Results in higher limit curve annex 10
Advise of ASEP Group to GRB

Annex 3:

Reconsider 2 m/s² boundary condition

- little effect on annex 3 result
- increases significantly effectiveness Annex 10
Limitation Annex 10

Anchor Point, Slope, Margin

That’s our job, so we are dealing only with a part of the stringency issue
Area of control
due to boundary conditions Annex 10

General: 3 forces to lower the engine speed

**Engine speed:** boundary means direct limitation

**Vehicle speed:** (related to test tracks lay out)
Lower speed $\rightarrow$ lower revs

**Acceleration:** $\rightarrow$ skipping low gears
$\rightarrow$ high revs not covered
By the way

Learned from R41 ad hoc Motorcycle group:

Direct limit on the $L_{wot,i}$
## Results Limitation Discussion

<table>
<thead>
<tr>
<th>Potential elements of the compromise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonus silent vehicles</td>
</tr>
<tr>
<td>Not testing i+1, i+2</td>
</tr>
<tr>
<td>Additional tests allowed if one test fails</td>
</tr>
<tr>
<td>Direct Limit on Lwoti</td>
</tr>
</tbody>
</table>

* in relation to discussion about Annex 3 Boundary Condition Acc < 2 m/s²

<table>
<thead>
<tr>
<th></th>
<th>Chairman Stringent</th>
<th>Compromise To be found</th>
<th>OICA Lenient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ann 10 boundary acceleration</td>
<td>No limit</td>
<td>?</td>
<td>4.0 m/s²</td>
</tr>
<tr>
<td>Ann 10 boundary Engine speed</td>
<td>90% of max</td>
<td>?</td>
<td>60-90% of max (dep PMR)</td>
</tr>
<tr>
<td>Anchor point*</td>
<td></td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Maximum slope</td>
<td>5</td>
<td>?</td>
<td>6-7</td>
</tr>
<tr>
<td>Margin</td>
<td>1</td>
<td>?</td>
<td>3</td>
</tr>
</tbody>
</table>

* in relation to discussion about Annex 3 Boundary Condition Acc < 2 m/s²
Other Issues

- Treatment CVT’s (raised by Japan)
- Replacement Silencers: workload and practical problems (raised by Clepa)
Remaining work to be done:

- Fine tuning method (CVT’s)
- Finalize Wording
- Stringency
Thank You
Need for ASEP control range at low engine speed (example 1)

Noise does not decrease at low engine speed
Need for ASEP control range at low engine speed (example 2)

Noise increases at low engine speed
Effect of changes in measuring method (example of 2 vehicles)

- 81/334/EEC measure "sportscars" in 3rd gear
- Assumed introduction 5 speed gearboxes
- Assumed introduction absorbing test track
- 96/20/EEC allowance worn tyres

Noise level type approval (dB(A))

- VW Polo 33 kW (model year 1998)
- Mercedes C 142 kW (model year 1998)

Legend:
- Limit
- VW Polo 33 kW (model year 1998)
- Mercedes C 142 kW (model year 1998)
Effect of changes in measuring method
(estimated effect total population)

Changes in measuring method

- gear tested
- test track surface and tyres

Sound level pass-by [dB(A)]

- 2nd
- 3rd
- 2nd + 3rd

- normal
- low noise