Introduction

Vehicle noise type approval test methods:
• Current method A – Regulation 51 – Addendum 50 – Annex 3
• New method B – Regulation 51 – Addendum 50 – Annex 10

Monitoring period of method B – parallel testing:
• UN-ECE: 01-07-2007 / 01-07-2009
• EU: 06-07-2008 / 06-07-2010

Test data submitted to European Commission
⇒ Stored in Circa web-site database
⇒ VENOLIVA project 1st goal: analysis of database
Questions to be answered by this study

• How to change limit values if method B is implemented?

• How to deal with current allowances for special vehicles?

• What is environmental, social and economic impact of implementation of method B + limit values?

• What is assessment of effectiveness of method B?

• Which modifications to method B are recommended?

• How can off-cycle noise emission be controlled?
Topics in the presentation

• Final contents of database
• Results of data analysis
• Relevance of allowances
• Policy options – proposed limit value changes
• Evaluation of method B
• Off-cycle emission provisions

• Impact analysis → presentation Michael Dittrich

• Conclusions & recommendation
Circa database - contents

- Final analysis based on contents database 07-07-2010

<table>
<thead>
<tr>
<th>Vehicle Category</th>
<th>Informal category description (see 2007/46/EC – Annex II)</th>
<th>Files in Circa database</th>
<th>Converted single vehicle files</th>
<th>Analysed single vehicles Files</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Passenger car</td>
<td>670</td>
<td>660</td>
<td>653</td>
</tr>
<tr>
<td>M1G</td>
<td>Passenger car for off-road use</td>
<td>-</td>
<td>26</td>
<td>24</td>
</tr>
<tr>
<td>M2</td>
<td>Medium sized bus</td>
<td>3</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>M3</td>
<td>Heavy bus</td>
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<td>76</td>
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<tr>
<td>N1</td>
<td>Small van</td>
<td>51</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>N1G</td>
<td>Small van for off-road use</td>
<td>-</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>N2</td>
<td>Medium sized van / lorry</td>
<td>34</td>
<td>58</td>
<td>55</td>
</tr>
<tr>
<td>N3</td>
<td>Heavy truck</td>
<td>179</td>
<td>118</td>
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<tr>
<td>N3G</td>
<td>Heavy truck for off-road use</td>
<td>-</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Files / data not usable</td>
<td>36</td>
<td>4</td>
<td>34</td>
</tr>
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<td><strong>Total</strong></td>
<td></td>
<td><strong>1029</strong></td>
<td><strong>1064</strong></td>
<td><strong>1064</strong></td>
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</tbody>
</table>
Circa database – Results (1)

- Noise emission according to method A and method B

<table>
<thead>
<tr>
<th>Vehicle category</th>
<th>Description</th>
<th>Number of vehicles</th>
<th>Average test results</th>
<th>Difference B – A [dB(A)]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Method A [dB(A)]</td>
<td>Method B [dB(A)]</td>
</tr>
<tr>
<td>M1</td>
<td>Passenger car</td>
<td>653</td>
<td>72,1</td>
<td>70,0</td>
</tr>
<tr>
<td>M1G</td>
<td>Pass. car -off-road</td>
<td>24</td>
<td>73,3</td>
<td>71,0</td>
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<tr>
<td>M2</td>
<td>Medium sized bus</td>
<td>28</td>
<td>74,4</td>
<td>73,4</td>
</tr>
<tr>
<td>M3</td>
<td>Heavy bus</td>
<td>76</td>
<td>77,8</td>
<td>77,1</td>
</tr>
<tr>
<td>N1</td>
<td>Van</td>
<td>52</td>
<td>73,7</td>
<td>72,0</td>
</tr>
<tr>
<td>N1G</td>
<td>Van – off-road</td>
<td>3</td>
<td>75,4</td>
<td>74,2</td>
</tr>
<tr>
<td>N2</td>
<td>Medium sized truck</td>
<td>55</td>
<td>76,3</td>
<td>75,0</td>
</tr>
<tr>
<td>N3</td>
<td>Heavy truck</td>
<td>100</td>
<td>79,7</td>
<td>80,9</td>
</tr>
<tr>
<td>N3G</td>
<td>Heavy truck – off-road</td>
<td>39</td>
<td>81,4</td>
<td>82,0</td>
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<tr>
<td>Total</td>
<td></td>
<td>1030</td>
<td>74,0</td>
<td>72,5</td>
</tr>
</tbody>
</table>
Circa database – Results (2)

- Noise emission according to method A and method B

![Average test results method A and B](chart.png)
Circa database – Results (3)

- Noise emission according to method A and method B

![Average difference test results method B - method A](chart.png)
Circa database – Results (4)

- Influence of engine type & gearbox type

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Engine type</td>
<td>Engine type</td>
<td>Gearbox type</td>
<td>Gearbox type</td>
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<td>71,7</td>
<td>70,3</td>
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<td>M1 number</td>
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<td>269</td>
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<td>M1G</td>
<td>72,1</td>
<td>73,9</td>
<td>70,9</td>
<td>71,1</td>
</tr>
<tr>
<td>M1G number</td>
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<td>16</td>
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<tr>
<td>M2</td>
<td>72,0</td>
<td>74,5</td>
<td>72,0</td>
<td>73,4</td>
</tr>
<tr>
<td>M3</td>
<td>77,1</td>
<td>77,9</td>
<td>76,8</td>
<td>77,2</td>
</tr>
<tr>
<td>N1</td>
<td>72,7</td>
<td>74,0</td>
<td>71,2</td>
<td>72,2</td>
</tr>
<tr>
<td>N1 number</td>
<td>9</td>
<td>43</td>
<td>9</td>
<td>43</td>
</tr>
<tr>
<td>N1G</td>
<td>75,4</td>
<td>74,2</td>
<td>77,1</td>
<td>72,0</td>
</tr>
<tr>
<td>N2</td>
<td>76,3</td>
<td>75,0</td>
<td>77,0</td>
<td>73,6</td>
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<tr>
<td>N3</td>
<td>79,7</td>
<td>80,9</td>
<td>80,0</td>
<td>79,5</td>
</tr>
<tr>
<td>N3G</td>
<td>81,4</td>
<td>82,0</td>
<td>81,4</td>
<td>81,3</td>
</tr>
</tbody>
</table>
Circa database – Results (5)

No significant influence on noise emission (method A or B) of:
• Cylinder capacity
• Engine power
• Power to mass ratio (PMR)

Explanation:
• Test method A: high powered cars adapted test method → WOT-test only in 3\textsuperscript{rd} gear
• Test method B: WOT-test in higher gears for higher PMR → lower engine speed at 50 km/h → relatively lower noise emission
Allowances – relevance & justification (1)

Allowance of 1 dB(A) for direct-injection Diesel engines

- M1 – passenger cars: only DI Diesels
- Difference Diesel – Petrol: Method A:  – 0,6 dB(A)
  Method B:  – 0,7 dB(A)
- M1G Off-road passenger cars
  → difference Diesel – Petrol:   A:  + 1,8 dB(A)
  B:  + 0,2 dB(A)
- N1 - Vans
  → difference Diesel – Petrol: A:  + 0,9 dB(A)
  B:  + 1,0 dB(A)
- But: 43 Diesel vehicles vs. 4 Petrol and 5 Gas vehicles

Conclusion: Allowance no longer relevant
Allowances – relevance & justification (2)

Allowance of 1 or 2 dB(A) for off-road vehicles

- Difference M1G – M1: method A: +1,2 dB(A)
  method B: +1,0 dB(A)
- Difference N1G – N1: method A: +1,7 dB(A)
  (number N1G = 3) method B: +2,2 dB(A)
- Difference N3G – N3: method A: +1,7 dB(A)
  method B: +1,1 dB(A)

Conclusions:

- Under test method B allowance of 1 dB(A) justified
- Only for vehicles that fulfil off-road criteria
  (Dir 2007/46/EC – Annex II – Art. 4)
- No evidence for 2 dB(A) allowance for all vehicles with engine power > 150 kW
- For N3G vehicles with engine power > 150 kW allowance of 2 dB(A) justified based on difference B-A
Allowances – relevance & justification (3)

Allowance of 1 dB(A) for High Powered cars (M1) – Criteria:

• Number of gears > 4
• Engine power > 140 kW
• Power to Mass Ratio > 75 kW/t
• Speed at line BB’ > 61 km/h

50 vehicles fulfilled criteria

Difference High Powered cars – Normal cars:

• Method A: + 1,7 dB(A) (HP cars in 3rd gear only)
• Method B: + 0,8 dB(A)
Allowances – relevance & justification (4)

HP cars - Influence of Power to Mass ratio on noise emission method A

\[ L \text{ method A} = 0.0045x + 73.159 \]

\[ R^2 = 0.0282 \]
Allowances – relevance & justification (5)

HP cars - Influence of Power to Mass ratio on noise emission method B

\[ y = 0.018x + 68.512 \]

\[ R^2 = 0.1514 \]
Allowances – relevance & justification (6)

HP cars – Results of method B as a function of results of method A

\[ y = 0.7676x + 14.409 \]

\[ R^2 = 0.2003 \]

High Powered cars -- Lurban - method B vs L-method A

Regression line M1 General
Regression line High Powered cars

\[ y = 0.7676x + 14.409 \]

\[ R^2 = 0.2003 \]
Allowances – relevance & justification (7)

- Noise emission of high powered cars is higher than other cars
- Increasing number of vehicles fulfils criteria

Conclusion:
- Allowance of 1 dB(A) is justified
- Proposed adaptation of criteria:
  - Power to Mass Ratio > 150 kW/t
Change of Limit Values – Policy Options

Five Policy Options:
1. No change: test method A; current limit values;
2. Test method B with current limit values;
3. Test method B with new limit values, equivalent to current situation;
4. Test method B with reduced limit values, aiming at noise reduction per motor vehicle
5. Test method B with reduced limit values, aiming at noise reduction per motor vehicle; in 2 step approach
Policy Options – elaboration (1)

• Option 1 – No change

• Option 2 – Test method B; current limit values;
  Allowances: off-road 1 dB(A)
  HP cars 1 dB(A)

• Option 3 – Test method B; new / equivalent limit values
  - Derivation equivalent limit values by 3 methods:
    • Regression equation result B as function of result A
    • Average difference between result B – result A
    • Distribution of results A and B → percentage non-compliant vehicles
Policy Options – elaboration (2)

- Regression equation → Result \( B = a + s \cdot \text{result A} \)

<table>
<thead>
<tr>
<th>Vehicle category</th>
<th>Regression line</th>
<th>Limit values for current method [dB(A)]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept ( a )</td>
<td>Slopes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Estimated limit values for new method [dB(A)]</td>
<td></td>
</tr>
<tr>
<td>M1</td>
<td>20,07</td>
<td>0,693</td>
</tr>
<tr>
<td>M1G</td>
<td>Not signft</td>
<td></td>
</tr>
<tr>
<td>M2</td>
<td>Not signft</td>
<td></td>
</tr>
<tr>
<td>M3</td>
<td>23,66</td>
<td>0,687</td>
</tr>
<tr>
<td>N1</td>
<td>34,86</td>
<td>0,504</td>
</tr>
<tr>
<td>N2</td>
<td>9,90</td>
<td>0,854</td>
</tr>
<tr>
<td>N3</td>
<td>Not signft</td>
<td></td>
</tr>
<tr>
<td>N3G</td>
<td>Not signft</td>
<td></td>
</tr>
</tbody>
</table>
Policy Options – elaboration (3)

- Regression
Policy Options – elaboration (4)

- Regression
**Policy Options – elaboration (5)**

• Average difference between result B – result A

<table>
<thead>
<tr>
<th>Vehicle category</th>
<th>Limit values acc. current method [dB(A)]</th>
<th>Estimated limit values for new method [dB(A)]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B - A mean</td>
<td>74</td>
</tr>
<tr>
<td>M1</td>
<td>-2,1</td>
<td>71,9</td>
</tr>
<tr>
<td>M1G</td>
<td>-2,3</td>
<td>71,7</td>
</tr>
<tr>
<td>M2</td>
<td>-1,0</td>
<td></td>
</tr>
<tr>
<td>M3</td>
<td>-0,7</td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td>-1,7</td>
<td>72,3</td>
</tr>
<tr>
<td>N1G</td>
<td>-1,2</td>
<td></td>
</tr>
<tr>
<td>N2</td>
<td>-1,2</td>
<td></td>
</tr>
<tr>
<td>N3</td>
<td>1,2</td>
<td></td>
</tr>
<tr>
<td>N3G</td>
<td>0,6</td>
<td></td>
</tr>
</tbody>
</table>
Policy Options – elaboration (6)

- Percentage of non-compliant vehicles
Policy Options – elaboration (7)

- Option 4 – Test method B; new reduced limit values
  - EU Regulation No. 661/2009 → average reduction limit values for rolling noise 3.8 dB(A) (Cars) / 3.3 dB(A) (Trucks)
  - From 1 November 2012 (new tyres types)
  - From 1 November 2013 (new vehicle types)
  - From 1 November 2016 (all new tyres and vehicles)
  - Estimated effect average rolling noise 3.3 – 3.8 dB(A)
  - Estimated effect cruise test Lcrs-rep 2.1 – 2.4 dB(A)
  - Estimated effect type test result light vehicles 1.3 – 1.7 dB(A)
Policy Options – elaboration (8)

- Option 4 – Proposed reduction of limit values:

<table>
<thead>
<tr>
<th></th>
<th>Light vehicles</th>
<th>Heavy vehicles</th>
<th>Implementation date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st stage</td>
<td>New types</td>
<td>- 3 dB(A)</td>
<td>1 January 2014</td>
</tr>
<tr>
<td>2nd stage</td>
<td>All vehicles</td>
<td>- 3 dB(A)</td>
<td>1 January 2016</td>
</tr>
</tbody>
</table>
Policy Options – elaboration (9)

Consequences of limit value reduction for percentage compliance for passenger cars
Policy Options – elaboration (10)

Consequences of limit value reduction for percentage compliance for heavy trucks

(method A; class N3)

(method B; class N3)
Policy Options – elaboration (11)

- Option 5 - Test method B; new reduced limit values in 2 steps

  - Effect of EU Regulation No. 661/2009 → Estimated effect on type test result light vehicles 1,3 – 1,7 dB(A)
  - First step reduction of limit values mainly based on rolling noise reduction
  - Second step will require power train noise reduction for > 50% of the vehicles
  - Some vehicles comply with reduced limit values already now

→ reduced limit values are considered feasible
Policy Options – elaboration (12)

- Option 5 – Proposed reduction of limit values:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Type</th>
<th>Light vehicles</th>
<th>Heavy vehicles</th>
<th>Implementation date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st stage</td>
<td>New types</td>
<td>- 2 dB(A)</td>
<td>- 1 dB(A)</td>
<td>1 January 2013</td>
</tr>
<tr>
<td>2nd stage</td>
<td>New types</td>
<td>- 2 dB(A)</td>
<td>- 2 dB(A)</td>
<td>1 January 2015</td>
</tr>
<tr>
<td>3rd stage</td>
<td>All vehicles</td>
<td>- 4 dB(A)</td>
<td>- 3 dB(A)</td>
<td>1 January 2017</td>
</tr>
<tr>
<td>Section (Reg. 51; Addendum 50; Rev 1)</td>
<td>Vehicle category</td>
<td>Description</td>
<td>Extra allowance option</td>
<td>No in database</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------------</td>
<td>-------------</td>
<td>------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>6.2.2.2.1</td>
<td>M1</td>
<td>Passenger car</td>
<td>Direct-injection Diesel engine</td>
<td>1 dB(A)</td>
</tr>
<tr>
<td>6.2.2.2.3</td>
<td>M1</td>
<td>Passenger car</td>
<td>Off-road; mass &gt; 2t; power &gt; 150 kW</td>
<td>1 dB(A)</td>
</tr>
<tr>
<td>6.2.2.2.2.1</td>
<td>M1</td>
<td>Passenger car</td>
<td>Off-road; mass &gt; 2t; power &lt; 150 kW</td>
<td>0 dB(A)</td>
</tr>
<tr>
<td>6.2.2.2.2.2</td>
<td>M1G</td>
<td>Passenger car - off-road</td>
<td>Direct-injection Diesel engine</td>
<td>1 dB(A)</td>
</tr>
<tr>
<td>6.2.2.2.2.3</td>
<td>M1G</td>
<td>Passenger car - off-road</td>
<td>Off-road; mass &gt; 2t; power &gt; 150 kW</td>
<td>1 dB(A)</td>
</tr>
<tr>
<td>6.2.2.2.2.2.1</td>
<td>M1G</td>
<td>Passenger car - off-road</td>
<td>Off-road; mass &gt; 2t; power &lt; 150 kW</td>
<td>0 dB(A)</td>
</tr>
<tr>
<td>6.2.2.2.1.1</td>
<td>M2</td>
<td>Medium sized bus; mass &lt; 2 tonnes</td>
<td>4 dB(A)</td>
<td>74</td>
</tr>
<tr>
<td>6.2.2.2.1.2</td>
<td>M2</td>
<td>Medium sized bus; 2 tonnes &lt; mass &lt; 3,5 tonnes</td>
<td>77 dB(A)</td>
<td>77</td>
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<td>6.2.2.2.1.3</td>
<td>M2</td>
<td>Medium sized bus; mass &lt; 2 tonnes</td>
<td>1 dB(A)</td>
<td>78</td>
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<tr>
<td>6.2.2.2.2.1</td>
<td>M2</td>
<td>Medium sized bus; 2 tonnes &lt; mass &lt; 3,5 tonnes</td>
<td>79 dB(A)</td>
<td>79</td>
</tr>
<tr>
<td>6.2.2.2.2.2</td>
<td>M2</td>
<td>Medium sized bus; 3,5 tonnes &lt; mass &lt; 5 tonnes; rated power &lt; 150 kW</td>
<td>12 dB(A)</td>
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<td>6.2.2.2.2.2</td>
<td>M2</td>
<td>Medium sized bus; 3,5 tonnes &lt; mass &lt; 5 tonnes; rated power &gt; 150 kW</td>
<td>4 dB(A)</td>
<td>81</td>
</tr>
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<td>6.2.2.2.2.2</td>
<td>M3</td>
<td>Full size bus; mass &gt; 5 tonnes; rated power &lt; 150 kW</td>
<td>11 dB(A)</td>
<td>82</td>
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<tr>
<td>6.2.2.2.2.2</td>
<td>M3</td>
<td>Full size bus; mass &gt; 5 tonnes; rated power &gt; 150 kW</td>
<td>64 dB(A)</td>
<td>83</td>
</tr>
<tr>
<td>6.2.2.2.2.2.1</td>
<td>N1</td>
<td>Van; mass &lt; 2 tonnes</td>
<td>21 dB(A)</td>
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<tr>
<td>6.2.2.2.2.2.2</td>
<td>N1</td>
<td>Van; 2 tonnes &lt; mass &lt; 3,5 tonnes</td>
<td>6 dB(A)</td>
<td>77</td>
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<tr>
<td>6.2.2.2.2.2.2</td>
<td>N1</td>
<td>Van; mass &lt; 2 tonnes</td>
<td>3 dB(A)</td>
<td>78</td>
</tr>
<tr>
<td>6.2.2.2.2.2.2</td>
<td>N1</td>
<td>Van; 2 tonnes &lt; mass &lt; 3,5 tonnes</td>
<td>22 dB(A)</td>
<td>79</td>
</tr>
<tr>
<td>6.2.2.2.2.2.2</td>
<td>N1G</td>
<td>Van - off-road; 2 tonnes &lt; mass &lt; 3,5 tonnes</td>
<td>7 dB(A)</td>
<td>80</td>
</tr>
<tr>
<td>6.2.2.2.2.2.2</td>
<td>N1G</td>
<td>Van - off-road; 2 tonnes &lt; mass &lt; 3,5 tonnes</td>
<td>7 dB(A)</td>
<td>81</td>
</tr>
<tr>
<td>6.2.2.2.2.2.2</td>
<td>N1G</td>
<td>Van - off-road; 2 tonnes &lt; mass &lt; 3,5 tonnes</td>
<td>7 dB(A)</td>
<td>82</td>
</tr>
<tr>
<td>6.2.2.2.2.2.2</td>
<td>N1G</td>
<td>Van - off-road; 2 tonnes &lt; mass &lt; 3,5 tonnes</td>
<td>7 dB(A)</td>
<td>83</td>
</tr>
<tr>
<td>6.2.2.2.2.2.2</td>
<td>N2</td>
<td>Lorry; 3,5 tonnes &lt; mass &lt; 12 tonnes; rated engine power &lt; 75 kW</td>
<td>1 dB(A)</td>
<td>74</td>
</tr>
<tr>
<td>6.2.2.2.2.2.2</td>
<td>N2</td>
<td>Lorry; 3,5 tonnes &lt; mass &lt; 12 tonnes; rated engine power &gt; 75 kW</td>
<td>1 dB(A)</td>
<td>75</td>
</tr>
<tr>
<td>6.2.2.2.2.2.2</td>
<td>N3</td>
<td>Heavy truck; mass &gt; 12 tonnes; rated engine power &gt; 150 kW</td>
<td>14 dB(A)</td>
<td>76</td>
</tr>
<tr>
<td>6.2.2.2.2.2.2</td>
<td>N3</td>
<td>Heavy truck; mass &gt; 12 tonnes; rated engine power &lt; 150 kW</td>
<td>14 dB(A)</td>
<td>77</td>
</tr>
<tr>
<td>6.2.2.2.2.2.2</td>
<td>N3G</td>
<td>Heavy truck - off-road; mass &gt; 12 tonnes; rated engine power &lt; 150 kW</td>
<td>14 dB(A)</td>
<td>78</td>
</tr>
<tr>
<td>6.2.2.2.2.2.2</td>
<td>N3G</td>
<td>Heavy truck - off-road; mass &gt; 12 tonnes; rated engine power &gt; 150 kW</td>
<td>14 dB(A)</td>
<td>79</td>
</tr>
</tbody>
</table>

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VENOLIVA - Vehicle Noise Limit Values
Brussels, 11 June 2010
Evaluation method B

Questions:
- What is effectiveness of method B compared to A, with respect to:
  - Practical applicability
  - Representativeness of results for noise emission in normal traffic
  - Significance of results for other operating conditions (off-cycle emissions)
  - Prevention of adapting or optimising vehicles to test conditions
  - Control of selection of test tyres on heavy trucks

Presented information based on enquiry among type approval authorities
Operability / complexity of method B

Light vehicles (M1, N1, N2<3.5t)
- Method B reproducible and manageable
- Method B for light vehicles 3 times more complex than method A
- Choice of gear ratio and approach speed less obvious
- Higher chance of mistakes
- Results more dependent of ability of the test driver
- Method B lower noise levels → more sensitive to environmental parameters and background noise → lower reproducibility than method A
- Instructions for use of gears for lockable automatics ambiguous

Buses: complexity A and B equal

Heavy vehicles
- Method B: loading instructions complex + ambiguous
- Method B: testing in less gears than method A
Representativeness of method B

- Test conditions method B more representative for urban driving than method A
- For some vehicles (e.g. light sports cars) choice of gears not representative for normal driving at prescribed speed
- At this moment no engineering of vehicles to the test conditions of method B → test conditions are representative for other conditions too → this may change in time
- Some noise generation mechanisms (e.g. high rev. exhaust noise) not addressed in representative way
- Contribution of tyre rolling noise to final test result: Estimation for light vehicles: 48 % (-3,2 dB)
Optimisation of vehicles to test conditions (1)

- Current vehicles optimised to method A → no vehicle exceeds limit values
- For method A high level cut-off of distribution
- For method B no cut-off; more Gaussian shape of distribution
- Some vehicles in test B above current limit values
- Apparently no “engineering to the test” yet
- Optimisation is considered feasible for method B too
- Estimated effect of optimisation for passenger cars:
  - 1 – 7 dB(A) for 10 – 15 % of vehicles
  - See histograms M1 vehicles
Optimisation of vehicles to test conditions (2)
Control of selection of test tyres on heavy trucks

**Enquiry type approval bodies:**
- In method A no strict instruction for choice of tyres
- Method B: tyres “shall be representative for the axle”
- Question: Is this requirement sufficient to prevent misuse?
- At this moment requirement seems to work
- Control of compliance with requirement difficult

**Circa data base:**
- For trucks different test tyres for method B than for method A
- N3 vehicles: results test B 1,2 dB(A) higher than test A
- N3G vehicles: results test B 0,6 dB(A) higher than test A
- Comparison traction tyres vs. steering tyres on drive axle:
  - difference 0,6 – 1,0 dB(A)
- Influence of test tyres on WOT test result not very significant
Recommendations for modification test method B

- Delete limitation of acceleration in WOT test of $2 \text{ m/s}^2$;
- Revise instruction for choice of gear for lockable automatics;
- Revise instructions for loading of heavy vehicles.
Off-cycle emission provisions (1)

General goals:
• Cover operating conditions not included in type test
• Noise emission never significantly higher than expected from:
  • Type approval test
  • Normal physical relation of noise with engine speed
• Minimise cycle beating possibilities
• Support law enforcement / in-use compliance
• Support conformity of production (COP) testing
Off-cycle emission – Evaluation GRB ASEP

ASEP = Additional Sound Emission Provision

• 2 methods proposed: GRBIG & NL
• Starting point both methods: noise level \( L_{WOT,i} \) method B
• Method GRBIG:
  - Primarily aimed at testing of linearity of noise - engine speed curve
  - Slope of curve based on noise test results of vehicle
  - No upper limit for noise emission
• Method NL:
  - Primarily aimed at setting a noise emission limit in addition to method B
  - Slope of curve determined by predefined maximum noise emission level
  - Can provide upper limit for noise emission within ASEP control range
Off-cycle emission – Evaluation GRB ASEP(2)

Pro’s and Con’s
+ Method 2 more distinguishing between normal and noisy vehicles
+ Method 2 reduces possibility of engineering to the test conditions
+ Both methods do not give false negative result for normal vehicles
- Both methods only effective within ASEP control range
- Method 1 provides margin for extra noise emission
- Method 1: no maximum allowed noise level
- Both methods based on engine speed → not useful for alternative drive systems
+ Method 2 easier to modify to vehicle speed dependency

→ Preference: method 2 (with reservations → modifications recommended → see VENOLIVA report)
Final results impact assessment
→ Michael Dittrich
Summary of Policy Options

• Option 1 – No environmental benefit
  – Method A no advantage over method B
  – Not recommended

• Option 2 – In fact increase of limit values
  – Negative environmental effect
  – Not advisable

• Option 3 – No impact on current vehicle fleet
  – No positive environmental effect
  – Not recommended
Summary of Policy Options (2)

• Option 4 – Reduction traffic noise impact:
  free flowing traffic: 2,5 dB(A)
  intermittent traffic: 2,8 dB(A)
  – Reduction number highly annoyed people 20%
  – Economic consequences manageable
  – Recommended, but less effective than option 5

• Option 5 – Reduction traffic noise impact:
  free flowing traffic: 3,1 dB(A)
  intermittent traffic: 4,0 dB(A)
  – Reduction number highly annoyed people 25%
  – Economic consequences manageable
  – Recommended as most effective option
Policy option 5 in historical perspective

Vehicle type approval noise limits - Option 5

Limit LAmax at 7.5m [dB(A)]

Year

Thank you for your attention !!!