Costs of new vehicle noise limits

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Proposed EU regulation on vehicle noise

In December 2011 the European Commission published a draft EU Regulation[1] for the sound level of motor vehicles. It proposes more stringent limit values for noise emission than the values currently in force and introduces a new test method as part of the type approval procedure, which is intended to be more representative of the actual conditions in normal urban traffic. Noise limit reduction in 2 steps is proposed in 2013 and 2015 (Phase 1/2/3), each of 2 dB. Other stakeholders have also proposed a further third step of another 2 dB for 2017 (Phase 4/5). Step 1 and 2 would reduce traffic noise levels by around 3 dB, and a third step would reduce it by another 2 dB (around 5 dB in total), assuming a further reduction of tyre noise. The technical feasibility and estimated costs to industry are summarized below, based on the VENOLIVA report[2] and a more recent analysis performed by TNO[3].

Technical feasibility of new limits

Both the 2 step limits and the third step limits are technically achievable. Much of the technology required for further noise reduction is available. This is demonstrated by the fact that part of the vehicles tested between 1 July 2007 and 1 July 2010 already fulfilled the limit values of the 2nd phase of the EC proposal:

- For passenger cars 22 % fulfilled the limit value of 68 dB(A) and 3% of 66 dB(A)
- For smaller vans 11 % fulfilled the limit value of 69 dB(A)
- For larger vans 6 % fulfilled the limit value of 70 dB(A)
- For heavy buses 18 % fulfilled the limit value of 75 dB(A) and 8 % of 73 dB(A)
- For heavy trucks 5 % fulfilled the limit value of 78 dB(A)

In this period no optimization or adaptation of the vehicles to the new test method had occurred. Even 2 dB(A) more stringent limit values for a third reduction step could be achieved already some years ago by a small percentage of the passenger cars and buses.

Further noise reduction for passenger cars has to be achieved by a combination of existing solutions such as engine design, encapsulation/shielding, absorption and muffler design, low noise tyre design, but also innovative solutions from R&D.

For step 2 limits for trucks, technology is commercially available for shielding and encapsulation, which is applicable without significant R&D effort. Also the additional reductions for step 3 limits are feasible, based on available technical solutions that have already been applied in passenger cars and engine test bench experiments. An additional cost of 250 Euro per dB noise reduction per vehicle is estimated for both Phase 2/3 and Phase 4/5, which is around 0,5 % of the vehicle price. This extra cost is passed on to the customer. For Phase 4/5 limits the additional costs for truck manufacturers are mainly due to additional R&D and tooling effort. As key challenges such as thermal management need to be addressed, the impact on the truck design and production will be larger than for the first limit value reduction.

Cost estimation

Costs for the automotive and tyre industry due to the introduction of stricter noise limits consist of additional R&D costs and additional production costs. The magnitude of these costs depends on the noise reduction required, the current levels, percentage of compliant vehicles, availability of technology and the timescale. Once noise reduction is integrated in the development process of new models after a whole product cycle of typically 7 years, both the development and production costs should be far lower than in the initial years. A multiplier of 1,16 is applied for additional costs for investment in R&D.

For cars, a substantial percentage already complies to the lower limits, and therefore the additional costs will be small. For vans, trucks, lorries and buses, solutions applied to cars and off-the-shelf noise reduction packages are available to fulfil the limits. A margin of 4 dB should be available for application of existing technology to fulfil the second step limits.

For third step limits for vehicles of new design, more R&D effort is required as only a small percentage of cars in the database currently fulfil those limits, and for trucks more R&D work on the engine and cooling system will be required. Additional manufacturing costs may be less as the production process can take required modifications into account at an early stage.

The costs for the tyre industry are based on an estimate for the development required to fulfil current limits and potential future limits. The Tyre industry annual turnover is estimated at 28 billion Euros, of which around 4% is spent on R&D. If 15% of this is spent annually on noise R&D, the annual R&D expenditure for the whole industry is 168 million Euros per annum, which runs from 2010 through until the first year of potential new tyre noise limits, possible around 2017. Tooling costs are not considered, as production machinery will be replaced anyway over that time period.

Based on industry consultation and cost change data from the 1980s and 1990s it is estimated that add-on noise reduction kits for trucks will cost around € 1500,- for second step limits and around € 3000,- for third step limits. This results in 500 Euros per dB reduction, but should be adjusted by around 50% for mass production and integration into the production process. So for trucks, lorries and buses, an increase of 250 Euro per dB noise reduction is used.

The updated costs for development and production are set out in the tables below. Annual additional R&D costs are set out in table 1, annual additional production costs in table 2 and total costs per annum including discounting at 4% and accumulated over the whole appraisal period 2010-2030 are listed in table 3.

The accumulated industry costs for the second step limits (4 dB reduction) over the appraisal period are 7 billion Euros (much lower than the ACEA estimate of 22 billion Euros). For third step limits costs are estimated at 10 billion Euros over the 20 year period 2010-2030.

These costs are far lower than the estimated benefits by a factor of 39 for second step limits and a factor of 32 for third step limits.

Table 1 - Estimated annual additional development costs for second and third step limits, as function of number of new models n_j per vehicle type j per annum, base annual development cost C_{dj} for first dB reduction, reduction margin NR_{0j} and required reductions NR_j for vehicle type j. A multiplier of 1,16 is applied for cost of investment.

Vehicle group j	n_j	Base annual devt. cost for first dB C_{dj} (€)	$NR_{0,j}$ dB	NR_j for Phase 2/3 dB	Additional annual devt. cost 2nd step $C_{dev,j}$ (M€)	NR_j for Phase 4/5 dB	Additional annual devt. cost 3rd step $C_{dev,j}$ (M€)
Cars	225	150.000	4	4,6	25,3	6,5	93,5
Vans	8	150.000	4	4,4	0,8	6,3	2,9
Buses	10	150.000	4	4,0	0,8	6,0	3,0
Lorries	10	150.000	4	3,0	0,4	5,0	1,5
HGVs	15	150.000	4	3,0	0,6	5,0	2,3
Total/year (M€)					27,8		103,1
Incl. investment multiplier 1,16					32,2		119,6

Table 2 - Annual additional production costs as a function of required noise reduction for Phases 2/3 and 4/5, number of vehicles produced per annum m_j and average additional production cost per dB of noise reduction C_{pj}.

Vehicle group j	Number of vehicles of type j produced annually m_j	Additional annual production cost per vehicle / dB C_{pj} (€)	NR 2nd step (dB)	Additional annual production cost $C_{prod,j}$ (M€)	NR 3rd step (dB)	Additional annual production cost $C_{prod,j}$ (M€)
Cars	14500000	20	4,6	916	6,5	1330
Vans	2200000	20	4,4	139	6,3	192
Buses	30000	250	4,0	23	6,0	30
Lorries	100000	250	3,0	50	5,0	75
HGVs	100000	250	3,0	50	5,0	75
Total(M€)				1177		1702

Table 3- Additional development and production costs for second (Phase 2/3) and third step limits (Phase 4/5) over the appraisal period 2010-2030 in million s of Euros and including a 4% discount rate.

M€	Phase 2/3				Phase 4/5			
Year	Development	Production	Total	incl. discount 4%	Development	Production	Total	incl. discount 4%
2010	200,2	0	200,2	200,2	287,6	0	287,6	287,6
2011	200,2	0	200,2	192,5	287,6	0	287,6	276,5
2012	200,2	0	200,2	185,1	287,6	0	287,6	265,9
2013	200,2	1702	1902,1	1690,9	287,6	2446,8	2734,4	2430,8
2014	200,2	1459	1659,0	1418,1	287,6	2097,2	2384,8	2038,6
2015	200,2	1216	1415,8	1163,7	287,6	1747,7	2035,3	1672,9
2016	200,2	972	1172,7	926,8	287,6	1398,2	1685,8	1332,3
2017	168,0	729	897,4	681,9	287,6	1048,6	1336,2	1015,4
2018	0	486	486,2	355,3	119,6	699,1	818,7	598,2
2019	0	243	243,1	170,8	119,6	349,5	469,1	329,6
2020	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0
Total M€	1570	6807	8377	6985	2540	9787	12327	10248

References

[1] COM(2011) 856 final, 2011/0409 (COD), Proposal for a regulation of the European parliament and of the council on the sound level of motor vehicles, European Commission, Brussels, 9.12.2011.

[2] Roo, de, F., M. Dittrich, e.a.: VENOLIVA – Vehicle Noise Limit Values – Comparison of two noise emission test methods – Final Report, TNO report nr. MON-RPT-2010-02103, TNO Science and Industry, Delft, 30 March 2011.

[3] F. de Roo, M. Dittrich, C. Bosschaart, B.Berry: Reduction of vehicle noise emission - Technological potential and impacts, Report for Transport and Environment and the Netherlands Ministry of Infrastructure and Environment, TNO report, April 2012.