

Amendments to ECE/TRANS/WP.29/GRB/2011/7 (marked in red)
REGULATION No. 51 (Sound emissions of M and N categories of vehicles)

I. Proposal

Annex 10, paragraph 2.2.2., amend to read (including the existing footnote ²):

"2.2.2. The tyres to be used for the test shall be representative for the ~~axle~~ **vehicle** and shall be selected by the vehicle manufacturer and recorded in Annex 9. They shall correspond to one of the tyre sizes designated for the vehicle as original equipment. The tyre is or will be commercially available on the market at the same time as the vehicle ². The tyres shall be inflated to the pressure recommended by the vehicle manufacturer for the test mass of the vehicle. The tyres shall have a tread depth of at least 80 per cent of the full tread depth.

² The tyre contribution for overall sound emission being important, this vehicle Regulation has taken into account the tyre/road sound emission regulations. **Traction tyres, snow tyres and special use** tyres according to UNECE Regulation No. 117 **as amended by the 02 series of amendments (2010)** shall be excluded during type-approval- and COP-measurements on request of the manufacturer."

II. Justification

1. The purpose of the testing described in Annex 10 to regulation No. 51 is to address the noise sources of the vehicle, which are of substantial importance for the further reduction of the overall noise emission of the vehicle during urban driving conditions, by means of a test performed on a test site.
2. All known studies dealing with the analysis of the urban traffic noise situation show that the tyre noise contribution in case of Heavy Commercial Vehicles (HCV), under torque and under rolling conditions during urban driving, has no influence on the overall noise emission of the HCV (see references in paragraph 14. below).
3. When calculation models such as TRANECAM are used to calculate the noise emission behaviour under real urban driving conditions, the parameter for the tyre road noise contribution in case of HCV is by default set to zero since its influence can be neglected.
4. **All known studies dealing with the analysis of the urban traffic noise situation show that nearly 98% of the noise from HCV is related to the power train (see references in paragraph 14. below).**
5. All known studies dealing with the analysis of the urban traffic noise situation show that the power train noise contribution in case of HCV has a significant influence on the overall noise emission. **Even if the share of HCV is only 6 per cent of the total amount of all vehicles in urban traffic the contribution from HCV to the total power train noise of all vehicles is almost 50 per cent** (see references in paragraph 14. below).
6. When the new measurement procedure in case of HCV were developed by the International Organization for Standardization (ISO), both information were taken into account to find an agreement on how to address the most important noise source of the vehicle, the power train, when simulating urban driving condition on a test site.
7. A WOT test was chosen to be the best alternative to address the most important noise source of the vehicle, the power train. The major disadvantage of the WOT test is that still generates acceleration levels which are higher than twice the ones achieved during real urban driving conditions. That is the reason by which the WOT test gives completely wrong results for the overall noise emission levels of the vehicle when traction tyres are used. The tyre noise contribution from the interaction between the tyre and the ISO-surface increases with torque with around 0.65 dB(A)/1000 Nm. This means that this noise source

becomes the dominating noise source during WOT testing and overshadows all other noise sources by far. It is a noise source which is exaggerated when testing under WOT conditions with traction tyres. Using normal tyres when performing the WOT test gives the possibility to solve this problem. This tyre is less sensitive to the torque. It increases with around 0.15 dB(A)/1000 Nm only. The influence of the noise contribution of the artificially created noise source is eliminated.

8. The majority of the results of the monitoring data base are based on the today's definition of the representative vehicle of the family - a vehicle with a wheel configuration of type 4x2 which is a vehicle with only two axles. As the results show the representative of the family is still the same for Method B as for Method A under the circumstances that normal tyres are used. When traction tyres are used the results show that the representative of the family for Method B is not the same anymore as for Method A. The use of these kind of tyres leads to the need of more than one family.

9. When introducing new types of vehicles manufacturers always introduce the vehicle with two axles in the first place. All kind of prototype vehicles which are needed to develop a new type are in general 4x2 vehicles. Vehicles with more than two axles are derived from the 4x2 and therefore not available in the early development phase. Their introduction date on the market is normally one to three years later.

10. The majority of the vehicles on the market are vehicles with two axles. The number of vehicles with three, four or five axles are small in comparison to the vehicle with two axles.

11. To built up new family concepts according to the numbers of axles and to the number of tyres which are representative for the axles will only be possible if vehicles with all different kind of wheel configurations are built and developed simultaneously and introduced on the market at the same time. This procedure will increase the development cost and the burden of homologation work for the manufacturers and their testing authorities tremendously.

12. Measurements with traction tyres under high torque have shown that the spread of the measurement results can be more than three dB(A) during one measurement sequence. The results are not reproducible. According to the demands of the Regulation a measurement sequence is valid if the spread of the individual measurement results is less than 2 dB(A). The major reason for this kind of non-reproducibility is that high torque and its resulting forces on the footprint of the tyre can more or less excite the Eigen modes of the structure of the tyre and its cavity. The tyre is working like a kind of loudspeaker membrane and causes air borne sound.

13. Taking into account the considerations mentioned above, paragraph 2.2.2. of Regulation No. 51, Annex 10 should be amended as proposed.

14. References:

- (a) Investigations on Improving the Method of Noise Measurement for Powered Vehicles (Report Number 10506067 by order of the Germany Federal Environmental Agency, August 1999, Steven, H.)
- (b) EU-Project WG8 Traffic Noise Calculation Study (TRL & RWTÜV 2004)
- (c) Investigation on Noise Emission of Vehicles in Road Traffic (TÜV Nord 2005)
- (d) Informal document No. GRB-51-20 (OICA 2010)
- (e) Informal document No. GRB-52-04 (OICA 2010)