

## (OICA) CONSIDERATIONS ON FUTURE ROAD TRAFFIC NOISE REGULATIONS

TYRE ROAD NOISE  
SOUND LIMITS  
ROAD SURFACE  
xEVS  
MINIMUM SOUND  
ASEP  
SINGLE EVENTS  
VEHICLE FLEET  
MEASUREMENT UNCERTAINTIES  
PREDICTION MODEL  
VEHICLE

### MAIN MESSAGES FROM THE PRESENTATIONS

#### REPRESENTATIVENESS OF the UN Regulation 51, 03 Series ANNEX 3 VIA SOUND MODELLING

- Although UN R51.03 (Annex 3) has been designed already in the years 2000-2005 based on real in-use driving statistics of the 1990's and products representative for that time, the test procedure does still cover the urban relevant sound sources for all vehicle categories in a representative way.
- The sound behavior under different driving situations is still covered by the test procedures of Regulation UN-R51-03 for passenger cars.
  - UN-R51-03 ASEP (Additional Sound Emission Provisions) has already brought a significant progress for the sound emission in driving situations other than type approval condition. RD-ASEP (Real Driving-ASEP) will further optimize ASEP.
  - The major sound source on motorways is tyre rolling sound from truck tyres, which are not covered by UN-R51-03.
- UN R51.03 alone cannot cover environmental noise in a holistic way. Within the frame of the UN type approval system, more regulations address environmentally relevant sources
  - UN Regulation No.138 – AVAS (Acoustic Vehicle Alerting System) for electric vehicles in urban areas
  - UN Regulation No.117 for especially C2 and C3 tyres (retreaded tyres?)
  - UN Regulation No.28 on the horn (see data analysis by BRUITPARIF [TFSL-04-05](#))
  - UN Regulation No.59 for NORESS (Non-Original Replacement Silencer Systems)

#### SINGLE EVENTS & RD-ASEP

- UN-R51-03 introduced extended requirements to cover not only urban driving situations, but as well other typical on road driving situations inclusive aggressive driving.
- ASEP has brought already significant improvements and RD-ASEP will provide further improvements.
- The UN Regulation R51 is a type-approval regulation on original equipment.
  - It cannot handle abuse of a vehicle and reckless driving behavior.
  - It does neither address nor cover aftermarket parts, such as replacement tyres or silencers.
- An increase of the market share of xEVs will help to reduce annoyance by single vehicles as their sound dynamic is much lower compared to combustion engine vehicles.
- OICA does not support a fixed limit on all driving conditions nor a limit on the acceleration test result similar to UN Regulation No.41.
  - Both ideas are not technically justified and will not provide a substantial benefit for the environment especially when looking to the wide field of "single events".

#### ELECTRIFIED VEHICLES (xEVs) & AVAS

- Pure electric vehicles will help to reduce potential annoyance from high powertrain noise due to high engine speed driving from ICE (Internal Combustion Engine), as their sound dynamic is much lower.

Electric vehicles will have the same sound emission and contribution to environmental noise as ICE vehicles whenever tyre rolling sound is dominant (road surface dependent > 50 km/h).

## SUMMARY

### REPRESENTATIVENESS OF UN-R51-03 ANNEX 3 VIA SOUND MODELLING

- The actual scope of UN-R51-03 is based on the Statistical background of ISO 362-1[1] on the Representativeness of the Test Method (Real Driving Cycles):  
The method provides excitation of all significant vehicle noise sources to provide the 90th percentile estimate of a vehicle's noise emission in an urban environment.
- RD- ASEP Based on a Sound Expectation Model (SEM) based on **physical principles** is assigned to each part source over its operation range. For every operation condition defined by vehicle speed, engine speed, load and performance an expected sound level  $L_{EXP}(v, n, a, v \cdot a)$  can be calculated.
- Sound Level Part Source Analysis
  - M1 vehicles (Various PMR): Tyre rolling sound is the dominant sound.
  - N2 and N3 vehicles: Power train noise reduction would make HDV vehicle quieter as single event in an urban environment, but these vehicles are rarely seen in urban environments and thus do little contribute to urban noise. On motorways the tyre rolling sound becomes the dominating source for the overall sound emission.
- Sound Level Part Source and Vehicle Category Analysis
  - URBAN AREA
    - M1 and N1 vehicles: Tyre rolling is the predominant source.
    - N2 and N3 vehicles: Lower limits for trucks will have little impact in urban conditions.
    - M2 and M3 vehicles: Do not contribute to  $L_{EQ}$  traffic noise in a significant way. Are relevant to single event consideration
  - MOTORWAYS
    - Tyre rolling sound is the dominant for all vehicles categories on motorways.
    - Truck tyres are not covered by UN-R51-03
    - With a share of 10%-15% of heavy commercial vehicles on motorways during daytime, trucks create the major source for environmental noise.
    - Powertrain sound from trucks contributes little to the overall sound situation.
    - Lower powertrain limits for trucks will not result in a comparable improvement on highway situation.

### SINGLE EVENTS & RD-ASEP

- WHO (World Health Organization) does not provide by now any recommendation, "as a relationship between single events and long-term negative health effects could not been proven".
- The vehicle sound emission regulation UN-R51-03 shall ensure that type approved vehicles have a sound performance consistent with physics and in line with the type-approved sound character.
- The provisions on ASEP introduced with UN-R51-03 provide already a good step forward, but RD-ASEP with its holistic approach will provide further progress especially on the maximum sound emission.
- Electric vehicles have a lower sound dynamic under high engine loads compared to ICE vehicles. More pure electric vehicles in traffic will help to reduce potential annoyance as single event from vehicles under extreme driving conditions.
- RD-ASEP is the right interim solution, to make sure that vehicles perform as technically foreseeable from the type approval and their sound emission will be dynamic limited.

### ELECTRIFIED VEHICLES (xEVs) & AVAS

- A complete replacement of all ICE vehicles by electric vehicles (with AVAS) will in best case provide a benefit of 0,6 dB(A) for speed ranges below 55 km/h.
- Even this is questionable given that xEVs have typically more rolling sound, because their higher weight results in wider or extra load tyres.
- EVs will not change traffic noise in situations where tyre rolling sound is dominant.

- At low driving speeds (up to 30 km/h), EVs equipped with AVAS will not provide a substantial benefit to traffic noise, their “powertrain noise” is determined by regulations.

#### ADDITIONAL POINTS FROM DISCUSSIONS IN THE UN TF-VS

- It has been supported to take into account different types of tyres and highlighted that tyre/road contribution, and not only vehicle/tyre contribution should be taken into account.
- Driving behavior has still a big influence on vehicle’s noise result. A balance has to be found between future RD-ASEP in type-approval process and beyond the Phase 3.
- How to take into account in limit values the electrification of the vehicle’s market?  
For xEVs including current AVAS, extra-load tyres and/or wider tyres are used which can be a game-changer compared to the current ICE vehicles.  
AVAS prevents vehicle noise improvements in speed range < 40 km/h => compromise to find between single vehicle detection (safety for other road users) and environmental noise.
- The Phase 3 seems to be not very effective in reducing ambient noise.
- OICA requested a moratorium to be able to continue works:
  - in progress as MU (Measurement Uncertainties), RD-ASEP, different studies on vehicles and on tyres, ..., and
  - to come as for R138 AVAS, R117 and retreaded tyres, R59 NORESS, tyres/road interaction, R28, ...

#### REFERENCES

- [TFVS-02-10 Rev.2](#) (OICA): Considerations on Future Road Traffic Noise Regulations
- [TFSL-03-05](#) (FRANCE/BRUITPARIF): Road noise in the environment – Measurements in real life

[1] ISO 362-1 Measurement of noise emitted by accelerating road vehicles — Engineering method — Part 1: M and N categories.