IMMISSION

Consider in parallel all the PART 3. sheets
Driver, Enforcement, Vehicle, Immission, Tyres/roads

DESCRIPTION / DEFINITION:

- IMMISSION means the sound recorded or predicted at receiver point, caused by emitting sources, as the average sound of the road vehicle fleet in continuous traffic flow or as single vehicle events, mitigated by abatement measures of various effect and efficiency (social impact and CBA). Immission represents sound waves reaching the receiver/observer vs. "Emission" means sounds from the sources.

- ***Keywords***: single events, traffic flow/condition, vehicle fleet, (alternative) abatement measures, prediction model, cross-matrix, social impact, Cost-Benefit-Analysis (CBA).

GENERAL FINDINGS/STATEMENTS FROM THE PRESENTATIONS/REPORTS

Treating sound immission calls for holistic and local approaches, while immission is related not only to vehicle and tyre noise themselves but also to other factors (road surface, traffic flow, single event, sound wave damping etc.). An increased market share of xEVs will reduce the average equivalent levels in low-speed mixed-category traffic and the annoyance caused by single vehicles as their sound dynamics are much lower than those of combustion engine vehicles.

The UN type approval system for M & N categories covers the relevant sound sources for those vehicle categories.
For M & N categories: Vehicle sound emission – UN R51 (Annex 3) – and minimum sound of electric vehicles – UN R138 – in urban areas; Tyre rolling sound emission – UN R117; Signal horn – UN R28 – (single events – reference BRUITPARIF TFSL-04-05); Non-Original Replacement Silencer System – UN R59; ASEP – extended requirement in UN R51 (Annex 7) – covering other typical driving situations, inclusive aggressive driving.

Single events,

- WHO (World Health Organization) concludes that “relationship between single events and long-term negative health effects could not been proven”.
- For instance, public surveys in Paris area indicate that ~50% of people living around and ~70% inside Paris are annoyed by noise being at home – mostly single events, whereas neighbors and motorbikes stand out.
- The single events – the major annoyance – caused by loud vehicles and uncivil behavior eliminate (mask) the improvements of vehicle propulsion and tyre sound emissions (the result of reduction of limit values).
- In Paris, a very small portion (1,5%) of high-level events (recorded higher than 80 dBA) represents 37% of the cumulated sound energy.

Alternative abatement measures,

Improve maintenance of roads, install silent road surfaces, control vehicle traffic flow, apply sound wave damping etc.
"Noise cameras" can provide local authorities or the police with enforcement tools to identify noisy vehicles, however the use of technology needs guidelines and appropriate noise thresholds including tolerances, and how to handle complex traffic situations.

Cross-matrix, traffic flow/condition, vehicle fleet,

Traffic noise studies need commonly agreed definitions of scenarios in order to support relevant road traffic models (Road types; Reference Road surfaces; Vehicle categories; Vehicle sound source models; Share of traffic volume per vehicle category; Story for noise reduction in power train/tyre; etc.).

- Road traffic noise were calculated in three studies based on traffic flow scenarios including main roads of different geographic areas of concern.
  The two studies/examples concerning EU suggested the fractions of 93-96% of light vehicles at daytime and 90-98% in the night. The remaining fractions are estimated to be more or less equally shared between mid and heavy-duty vehicles.
  The Japanese studies estimated much higher rate of mid and heavy-duty vehicles both day (20-30%) and night (45-64%) compared to EU main roads.
- The sound levels of new vehicles themselves have decreased with improved limit values, but the effect on road traffic noise is delayed due to the year rate of market penetration of new vehicles.
- A study for distribution of electrified Vehicles will become important in the future. AVAS (Acoustic Vehicle Alerting System) is expected to have impact on the road traffic noise in the speed range lower than 40 km/h.

Prediction model,

- Reports (e.g. PHENOMENA) recognizes/anticipates gaps between the END/CNOSSOS methodology, the TA test and real traffic noise.
  Different countries and cities are in progress to collect technical information especially related to the vehicles and traffic flow (range of acceleration, manipulated vehicles, …). The correlation of pass-by noise measurements between vehicle homologation and source model description can be still improved. Nevertheless, there is a good correlation between computed environmental noise maps and measurements. Thus, tougher regulation has no real effect to reduce citizen complaints.
  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 quieter as single event in an urban environment, but these HDV are rare in urban traffic and thus contribute little to urban (average) noise. With higher speeds the tyre rolling sound becomes the dominating source. Heavy duty EVs have the capacity to reduce sound levels in low-speed traffic according to ATEEL (TFVS-07-04).

Social impact,

- The available reports and presentations in TFVS reveal national goals regarding improved road traffic noise of EU and Japan. The goals are referring to average sound immission levels (L_{eq}/L_{den}/L_{night}).
  Japan – Ministry of Environment – targets 100% EQS (Environmental Quality Standards) which means Leq below certain limit, and to reduce complaints from citizens related to road traffic noise.
  The European Commission proposed a policy target of reducing the share of people chronically disturbed by transport noise by 30% by 2030 in the Zero Pollution Action Plan (compared to 2017).
- The most annoying sources of noise among transport noises in Ile de France are the noise coming from 2 wheelers and horns [1].
  A second survey conducted by Bruitparif [2] shows that 49 % of the annoyance is related to road traffic in which passenger cars represent 25 % of the annoyance.

Cost-Benefit-Analysis (CBA)

Although Cost and Benefit Analysis are desired by stakeholders and required by policy makers it provides lots of room for questions and discussions and, an established balance between relevant aspects and a commonly accepted quota seems hard to derive. Therefore, assumptions and boundary conditions require further description for better understanding, assessment and then improvement. An effective reduction of noise health burden can only be reached by a set of combined and complementary traffic noise abatement measures, and have to be backed up by corresponding efficiency analysis (Cost Benefit Ratio).

NEEDS & QUESTIONS FOR FURTHER CONSIDERATION FROM THE ORIGINAL PRESENTATIONS/REPORTS:

- The hypothesis and assumptions of different studies (ref. 20, 22, 23) should be reviewed.
- The existing noise mapping models should be revised to better align with the real-life situation taking into account progress, recent studies and technical innovations.
- The effectiveness of vehicle noise reduction beyond phase 3 (and every phase) should go through a technical review before reaching global agreement. The studies on the subject presented to TF-VS conclude that benefits of further limit reductions are highly limited and time delayed.
- Evaluate the distribution and effect of xEV/electrified vehicles.
- CBA and the corresponding assessment of health benefits should be considered year by year and location by location.
  Combine alternative abatement measures where they are most efficient (traffic hot spots) and compare with measures on vehicle sources where they are most efficient.

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