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POSITION PAPER

The European Union Road Federation

Road Traffic Noise
The Road Sector's Perspective

Introduction

Traffic noise is a typical area of conflict between individual mobility needs and legitimate societal aspirations for quieter lifestyles. With some 80 million EU citizens suffering from unacceptable levels of noise – much of it caused by the transport sector as a whole – there is a clear need for Europe to take a driving role in promoting targeted legislation, sharing solutions and achieving a common understanding of the potential for progress.

Public concern over noise issues has never been so high, partly because the overall increase in road traffic has tended to counterbalance the real progress achieved by all segments of the road transport sector in the last decade.

While road traffic noise components are to be found essentially in propulsion noise and tyre-road interaction, the vast array of preventive and remedial measures extends to quieter road technology, noise reducing devices, traffic management strategies and long-term mobility and land use planning solutions.

The real challenge therefore lies in identifying a combination of pragmatic measures that will reduce overall sound emission without impeding mobility and its associated socio-economic benefits. This paper prepared by the ERF Working Group on Road Traffic Noise provides a first step towards understanding how the road sector can contribute to this goal.

Executive Summary

Noise is wholly subject to personal tolerance levels and its effect on the human ear typically depends on a complex combination of contextual factors. Nevertheless, it is generally accepted that a 55 dB(A) sound will be disturbing whereas a 65 dB(A) noise level will be deemed intolerable. By this measure, and according to official statistics, **up to 250 million Europeans suffer from noise-related disturbances,** at an estimated cost to society of EUR 38 billion. Much of this is caused by traffic-related sound originating from all modes of transport.

For road transport in particular, research has conclusively identified the various noise components as a combination of rolling noise and propulsion noise. Significant progress has been achieved in both sources, through new tyre design and quieter engines. However, there remains much scope for progress as quieter cars will never eliminate erratic driving behaviour or technical defects. In addition, the increase in road traffic and the progressive introduction of heavier vehicles has tended to counter-balance the progress achieved in the last decade.

"quieter cars will never eliminate erratic driving behaviour, technical defects and traffic density which together can have a multiplying effect on noise emission"

In recent years, the automotive sector's Research & Development efforts have been matched by progress from the road sector itself. **Silent road surfacing** offers improved acoustic performance levels and constitutes an affordable solution to tyre-road interaction noise. **Acoustic barriers** and other noise reducing devices built alongside high-traffic roads offer effective on-site remedial measures with the capacity to cut traffic noise by as much as one half. Finally, **traffic management strategies** coupled with ITS technologies and enforcement policies can significantly contribute to the noise equation. In the long run, the objective of significantly reducing public exposure to traffic noise can only be reached if noise abatement is integrated into European mobility and land-use planning action programmes.

Achieving an effective road traffic noise policy requires above all a concerted approach that balances overall road-related sound emission without affecting citizens' right to mobility. This paper makes a number of constructive suggestions towards achieving this balance, including a common approach to noise measurement and standards, a better understanding of the links between road maintenance and acoustic performance, practical guidelines for the benefit of road authorities, market-friendly measures, and a generalised usage of noise simulation technologies.

Road Traffic Noise : The Road Sector's Perspective

What is traffic noise ?

Noise is generally described as unwanted sound and wholly subject to personal tastes and tolerance levels. In addition, the sensitivity of the human ear to noise depends on an number of contextual factors which typically include wind factor, humidity, traffic density, etc. Nevertheless, it is generally accepted that a 55 dB(A) sound will be disturbing whereas a 65 dB(A) noise level will be deemed intolerable, causing severe sleep disturbance (source: OECD).

According to this classification, **up to 80 million Europeans suffer from unacceptable levels of noise** while another 170 million live in "grey areas" where sound is a major nuisance. Through sleep disturbance, loss of productivity and decreases in property value, the economic damage of environmental noise in the EU could reach as much as EUR 38 billion. As a case in point, Germany estimates that for each 1dB(A) increase in noise levels, average property values fall by 0.5%.

Much of this is caused by traffic-related sound originating from all modes of transport.

Road traffic noise in particular is caused by the combination of **rolling noise** (arising form tyre-road interaction) and **propulsion noise** (comprising engine noise, exhaust systems and transmission intake). It is generally estimated that tyre-road interaction is the main source of noise above 55 kph for most cars and above 70 kph for trucks, depending on the age, weight and driving conditions of the vehicle.

The dB(A) measure

Sound is universally described on a logarithmic decibel (dB) scale of 0 dB (threshold of audibility) to 140 dB (threshold of pain). Using this scale, a doubling of sound pressure corresponds to a six decibel increase in sound level.

In addition to level or loudness, sound has a frequency component. The human ear is, in general, capable of detecting frequencies between 20 to 20,000 Hertz. The ear is more sensitive to high frequency sounds than to low frequency sounds.

Because of this, the A-weighting network was developed and is applied to measured or predicted noise levels to mimic the ear's varying sensitivity to frequency. Resulting noise levels are expressed in dB(A).

Significant progress has been achieved in both sources of noise, through new tyre design (such as randomised tread pattern, narrow lateral grooves, etc.) and quieter engines (through acoustic shielding of the engine and multiple muffler systems). However, there remains much scope for progress - particularly as quieter cars will never eliminate erratic driving behaviour, technical defects or even traffic density which together can have a multiplying effect on noise emission. In addition, an overall increase in road traffic and the progressive introduction of heavier vehicles have tended to counter-balance the real progress achieved through better car and tyre technology.

What is the potential for progress ?

In recent years, the automotive sector's Research & Development efforts have been matched by progress from the road sector itself.

Different road surfaces offer varying acoustic performance levels and constitute an affordable solution to tyre-road interaction noise. It is estimated that surfacing relief, road evenness and sound absorption features on a well-maintained road network can reduce noise emission levels by as much as 5 dB(A) compared with classic pavement surfaces. Having established that there is no trade-off between low-noise surfacing and skid resistance, research is now concentrating on classifying road surfaces on the basis of scientifically-researched acoustic performances and improving the durability of low-noise pavement.

In addition, **acoustic barriers** and other on-site noise reducing devices (such as absorption treatment or acoustic joints) offer an effective remedial measure in high-traffic density zones or specific high-noise areas. Acoustic barriers are solid obstructions (such as an earth mound or a vertical wall) typically built alongside high-traffic roads and which reduce noise levels by either absorbing the sound, transmitting it, reflecting it back across the road, or forcing it to take a longer path over and around the barrier. Effective acoustic barriers typically reduce noise levels by 5 to 10 dB(A), cutting the loudness of traffic noise by as much as one half – equivalent to reducing the sound level of a typical tractor trailer pass-by to that of a passenger car.

Finally, **traffic management strategies** can play an important role in reducing noise at the source (eg. night time speed limitation, "quiet areas", etc.), especially coupled with effective ITS technologies and enforcement policies which enable an active monitoring of the worst noise offenders.

A combination of these measures can help reduce daytime noise levels to under 50db(A) , which is the upper limit often used to describe a "quiet area" in an urban environment. Simulation tools can be particularly helpful in predicting the actual effectiveness of individual or combined anti-noise measures.

In the long run the objective of significantly reducing public exposure to traffic noise can only be reached if noise abatement is integrated into European mobility and land-use planning action programmes. Specifically, solutions such as underground urban tunnels and shielding residential areas with office blocks offer undoubted potential.

What are the pillars of an effective traffic noise policy ?

Achieving an effective road traffic noise policy requires above all a concerted approach that balances the need to reduce road-related sound emission without affecting mobility and its associated socio-economic benefits.

This in turn translates into the following recommendations :

- A single Europe-wide approach to measuring road noise and assessing its cost to society,
- A shared understanding of the links between road maintenance levels and the efficiency of noise absorption devices,
- Noise standards and regulations which are defined, applied and enforced at European level,
- Information campaigns targeted at local and national decision-makers in view of raising awareness of recent European legislation (see box),
- Deployment guidelines to assist authorities in the selection, installation and maintenance of road surfaces and acoustic barriers based on European norms and local traffic conditions,
- A balanced mix of regulation and market-friendly measures, such as economic incentives that promote innovation, or road construction contracts that incorporate acoustic performance service levels,
- Generalised usage of road noise simulation tools and ITS-based enforcement technologies,
- Research into the noise impact of innovative mobility concepts, such as urban tunnels and separated traffic flows.

The EU noise framework

- Sixth environmental action plan outlining EU vision "to avoid harmful effects of noise exposure from all sources and preserve quiet areas",
- 1996 Green Paper on Future EU Noise Policy set the general principles for harmonised noise assessment methods and information to the public,
- Noise source legislation: outdoor equipment (COM 2000/14/EC) and tyres (COM 2001/43/EC),
- Environmental Noise Directive (COM 2002/49/EC) : Member States required to produce noise maps by 2007, draw up strategic action plans and undertake public information campaigns.

The European Union Road Federation

The ERF is a non-profit association which coordinates the views of Europe's road sector and acts as a platform for dialogue and research on mobility issues.

Launched in 2003, the ERF Working Group on Noise brings together organisations active in the areas of road surface design, acoustic sound walls and traffic management technologies. Its main objectives are to promote cross-industry exchanges, encourage the adoption of effective noise management policies and publish industry recommendations.

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