

Can you hear us?



Why it is finally time for the EU to tackle the problem of noise from road and rail traffic

T&E

European Federation for
TRANSPORT and ENVIRONMENT

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The scientific facts and explanations underpinning this brochure, unless otherwise specified, are available in a review of up-to-date noise research commissioned by T&E and carried out by consultants CE Delft. The review, 'Traffic Noise Reduction in Europe: Health effects, social costs and technical and policy options to reduce road and rail traffic noise' (Delft, 2007), is available on request from T&E.

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Time to listen

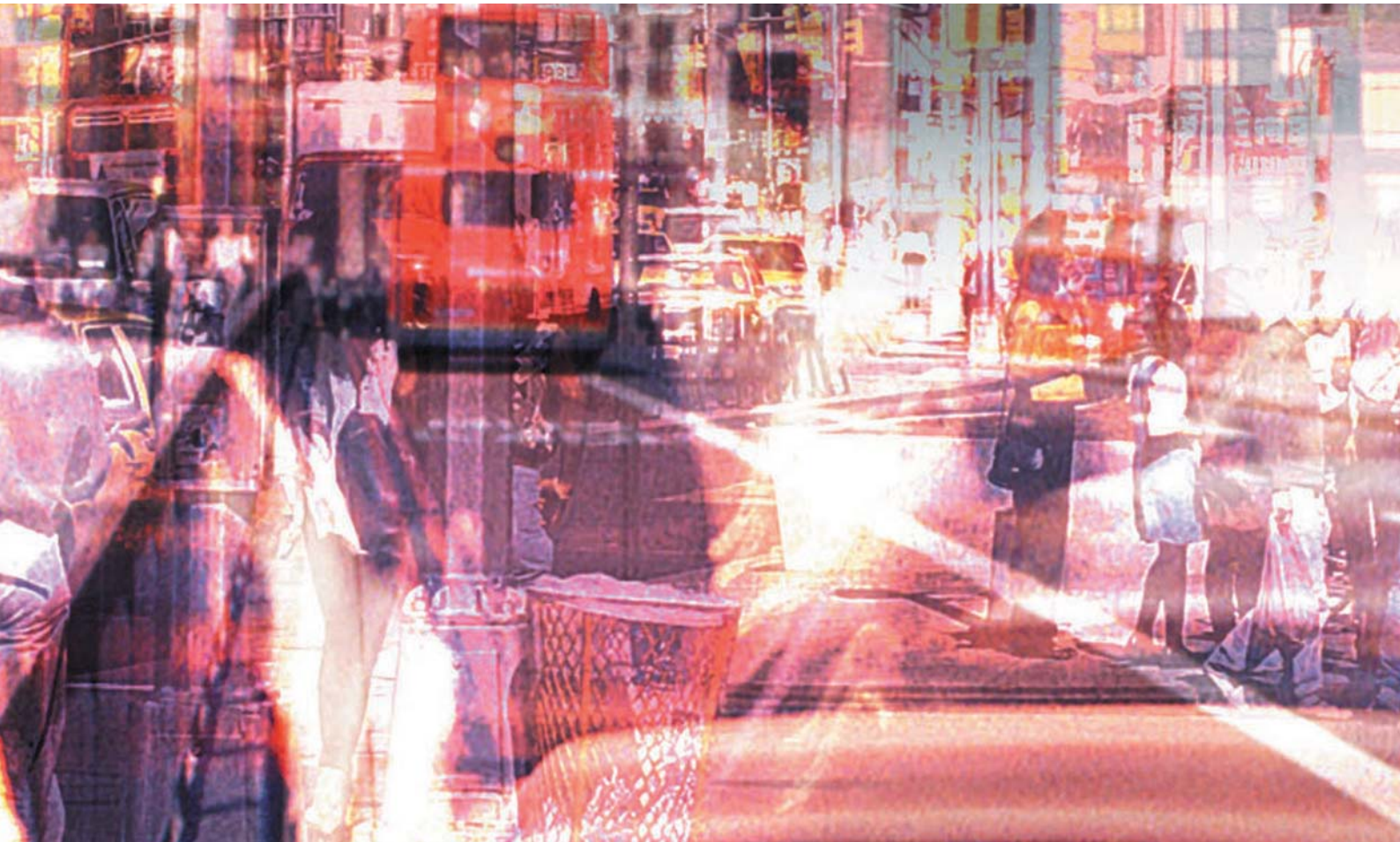
The harmful effect of traffic noise is one of the most widespread environmental problems in Europe, and yet ironically one of the most neglected in terms of awareness and actions to combat it. The result is our roads and railways are getting louder. The noise problem is getting worse.

Traffic noise is a Europe-wide problem, given that the vast majority of Europeans live in cities, and over a quarter of us live in close proximity to very busy roads. So it is appropriate that the EU has competence to legislate on traffic noise, but very frustrating that very little has been done. The problem has been underestimated and ignored, and not enough use has been made of several easy ways to make things better.

In comparison, for example, with EU action on air pollution, which includes air quality standards and emissions limits for vehicles, the EU has neglected its duty to protect citizens from noise. And yet both are environmental problems, largely caused by traffic, with very serious public health effects and high costs to society.

The European Commission is due to take new action on environmental noise, of which traffic noise is the major source, in 2009. In the meantime, there are many other actions that the EU can take to give us all quieter lives. This brochure offers a tour of the problem, the arguments and the solutions – and shows why a tightening of standards is long overdue.

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When sounds become the problem of noise

A certain level of sound is absolutely fine – we have ears, and it's nice to be able to use them. But there comes a point at which sounds become uncomfortable, and beyond that level we talk of noise. For every person, that point is different, and different sounds can be benign or malign depending on circumstances. But the World Health Organisation recognises noise as a serious and widespread danger to public health, and research carried out for the WHO has shown that

If people are exposed to regular noise levels of 55 decibels or more, the effect on their health can be damaging, in some cases even potentially fatal.

Those health effects can include:

- ✦ Sleep disturbance
- ✦ Disruption to learning and understanding (especially in children)
- ✦ Annoyance leading to stress
- ✦ Raised blood pressure leading to certain heart problems
- ✦ Certain adverse effects on mental health

And it's the most vulnerable members of society – children, elderly people, and those already in poor health – who suffer most! There is a social equity question too – homes in noisy areas tend to be cheaper (and those in quiet areas come at a premium), so people on low incomes are also likely to be at greater risk. There is even some evidence to suggest traffic noise can affect the development of foetuses in the womb by increasing a pregnant woman's stress levels.

Measuring noise

Noise is measured in decibels, but the decibel system requires some explanation. The decibel scale is logarithmic – so a three-decibel increase means a doubling of the volume of sound, and a 10-decibel increase means the sound is 10 times louder. For example, an aircraft passing overhead is likely to be 20 decibels – or 100 times – louder than a normal conversation. Levels of environmental noise are often reported as averages over a sustained period.

The short form for decibels is generally dB but noise is often given in dB(A) units. The (A) is added to denote that the scale has been adapted for the human hearing range. For example, 20dB(A) equates to a gentle breeze or a soft whisper. Sounds that are louder than 120dB(A) – the level of noise when a military aircraft takes off – can make people feel fear and sometimes pain.

Another complication of decibel measurement is that it's not just the level of sound that indicates its impact. Other important characteristics of noise include its soundwave frequency (pitch), whether it's continuous or intermittent, how long it lasts, what time of day it occurs at, and even any thoughts associated with it. For example, a mosquito makes very little noise, but if you hear it in a quiet bedroom while you're trying to sleep and know it can bite, its buzzing can seem very disturbing. In general, an intermittent sound, such as one passing lorry on an otherwise quiet road, is often more disturbing than a constant background noise, such as a busy road.

Scientifically recognised and quantifiable concepts

The terms 'annoyance' and 'sleep disturbance' may seem to some as just subjective judgements of a complaining nature. Yet in the study of noise, they are the headings used for quantifiable and measured adverse effects. Looking at them in more detail:

Sleep disturbance ... uninterrupted sleep is known to be a prerequisite for proper physiological and mental functioning in healthy people, so if sleep is disturbed – especially if it happens regularly – people's ability to function is affected, and this can lead to reduced productivity among working adults and impaired learning ability among children. *And sleep is disturbed by traffic noise – in fact traffic noise is the main cause of sleep disturbance.*

People don't need to be wakened for sleep disturbance to kick in – a noise that simply takes them from deep sleep to lighter sleep at the wrong time of night can increase stressful hormone levels, raise blood pressure, and cause tiredness, irritability and mood swings the following day. Over long periods, this can lead to insomnia and necessitate increased use of medication. The effects can start with as little noise as 32 decibels, and people can be fully awakened from 40 decibels.

Learning, understanding and concentrating ... Exposure to traffic noise can impair a person's cognitive functioning (information processing, understanding and learning). Much depends on the kind of noise and the work being done, but the more demanding the task, the more vulnerable the person doing it is to noise, which means the economic impact of the noise will be greater. Research has found that children exposed to high levels of traffic noise suffer from:

- ◀ Difficulty concentrating
- ◀ Difficulty sustaining attention
- ◀ Difficulty remembering complex issues
- ◀ Poorer reading and general school performance
- ◀ General difficulty discriminating between sounds (for example a teacher talking against background noise) and poorer perception of speech





Annoyance ... We all get annoyed by certain things, and sometimes that annoyance is merely a reflection of our tolerance threshold in a given moment. But in noise studies, the term annoyance is used to denote a measurable adverse human reaction when the body is exposed to certain levels of sound. Annoyance is usually measured by field studies, where people report their own reactions, coping mechanisms and evaluation of the severity of the problem. Some recent studies also suggest that beyond reported annoyance, a person may have a chemical and psychological reaction of the body when exposed to certain noise levels, especially when asleep.

The World Health Organisation says the capacity of noise to cause annoyance 'depends on its physical characteristics, including the sound pressure level, spectral characteristics and variations of these properties with time.' It says few people get seriously affected by noise levels below 55 decibels, but above that limit, there can be damage to human health, especially where exposure to noise is constant at certain times of day and over a prolonged period.

Annoyance is the most widespread problem created by noise, and in certain circumstances it can affect our behaviour and be expressed by fear, uncertainty and anger. These responses can lead in turn to subconscious reactions, such as raised blood pressure.

Mental health ... research into the link between mental health and traffic noise is still in its infancy, with more work needing to be done, but there is embryonic evidence that noise may well accelerate and intensify the development of latent mental disorder; and that people already suffering mental problems are likely to be more sensitive to the effects of traffic noise than the general population.

Other problems ... there are other problems too. Some animals can be adversely affected, and while this may not seem of major importance as an issue, if it affects the nature chain, it can cause environmental problems further 'down the line'. Noise from traffic may disrupt hunting, nesting or mating patterns. For example, bats are totally reliant on echo location so are unable to find food if noise levels are too high.

How can noise be fatal?

Exposure to traffic noise triggers the release of certain hormones, which can lead to changes in blood pressure and to a greater risk of some heart diseases (e.g. ischemic heart diseases, angina pectoris, myocardial infarction). Noise triggers the production of stress hormones like cortisol, noradrenaline and adrenaline, which is especially dangerous over long periods of exposure.

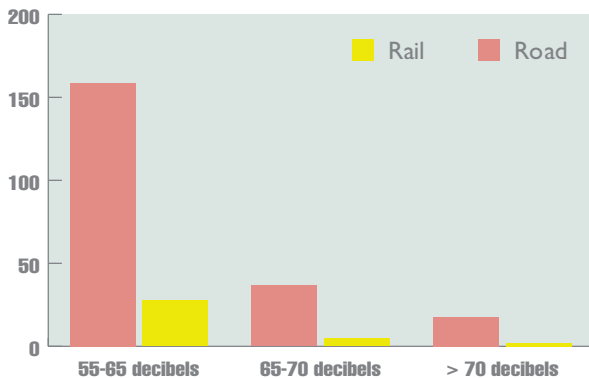
For people living in streets with average noise levels above 65-70 decibels, the risk of heart disease is on average 20% higher compared with people in quieter streets. And while some noise problems get better as people think they are getting used to them, noise-related cardiovascular problems show no signs of improving with time.

Around 50,000 people in the EU die prematurely each year from heart attacks caused by traffic noise. Almost 200,000 more suffer from cardio-vascular disease linked to traffic noise.



Traffic's contribution to environmental noise

NUMBER OF PEOPLE EXPOSED (in millions) TO ROAD AND RAIL TRAFFIC NOISE IN 25 EU COUNTRIES* IN 2000



* Countries included: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Romania, UK.

Traffic is not just a major contributor to noise, but it's the most widespread source of environmental noise. Road traffic is by far the biggest culprit.

55 decibels is the World Health Organisation's threshold for 'serious annoyance' and onset of negative health effects

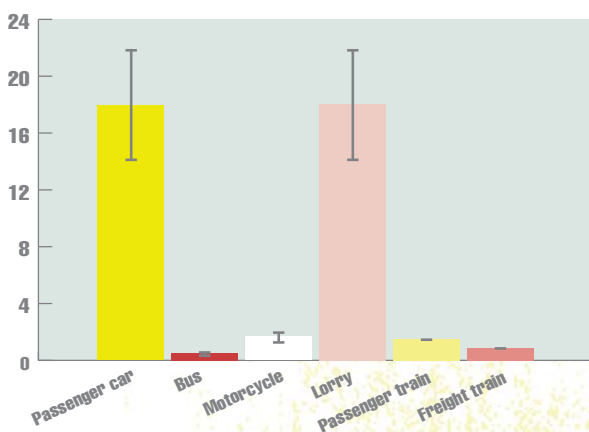
Road traffic ... around 210 million citizens of the European Union are regularly exposed to 55 decibels or more of road noise

Railways ... around 35 million EU citizens are regularly exposed to 55 decibels or more of rail noise

And people die! Around 50,000 people in the EU die prematurely each year from heart attacks caused by traffic noise. And there are nearly 200,000 cases of non-fatal cardio-vascular disease.

The cost of noise

DISTRIBUTION OF SOCIAL COSTS (in bn euro) DUE TO TRAFFIC NOISE IN THE EU22* OVER TRANSPORT MODES (2006 price level)



* Countries included: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK.

When noise has an impact on people's ability to function, there are costs involved to society.

There are various ways the economic cost of noise can be measured. A common approach is 'willingness to pay', judged by what people are willing to pay to avoid noise – this could be measured in terms of surveys asking people what they would happily pay to get out of a noisy area, or in terms of what they already do pay, for example how much more expensive a house is in a quiet area compared with a noisy area, when all other factors are equal. In addition, all governments put a monetary value on a life lost prematurely, to measure the loss in GDP to the national economy. And there are calculations such as the number of additional sleeping pills needed in loud areas, or the number of days at work lost due to noise-induced illness (where this can properly be attributed to noise).

The ways of measuring the economic cost of noise damage vary from country to country, so any EU-wide total is going to be based on averages. But a conservative estimate is that **the social costs of traffic noise are €40 billion per year**, of which 90% come from cars and lorries. That's a loss of 0.4% of total EU GDP. By comparison, noise costs to society are about 30% of the cost of road accidents (but get nothing like 30% of the political attention).

Who pays?

Currently society in general covers the costs. Those who suffer negative effects on their health, sleep or wellbeing pay 'in kind'. Poor people can only afford homes in noisy areas. Employers pay through lost work time and productivity; taxpayers pick up the bill for noise walls or insulation of public buildings, increased health care costs, and so on.

What can be gained by tackling traffic noise



Reducing traffic noise across Europe will bring major economic benefits, among them:

- ◀ The number of health problems will decline, with a corresponding drop in medical costs
- ◀ More people will be more productive at work and take less sick leave
- ◀ Children will learn better at school
- ◀ If noise is reduced at source, councils and highway authorities will need to spend less on anti-noise walls
- ◀ There will be less of a socially harmful discrepancy in property values

In fact one study put the perceived benefit of noise reduction in monetary terms at €25 per household per decibel per year!

The social costs of traffic noise are at least €40 billion per year

How to tackle traffic noise

There are two obvious ways to stop people being affected by noise:

- ◀ **Stop the noise** – known as 'at-source measures' (quieter engines, exhaust, tyres/wheels, quieter brakes on trains, traffic management, etc)
- ◀ **Stop people hearing the noise** – known as 'anti-propagation measures' (sound insulation in buildings, or erecting embankments and walls to put a barrier between people and the source of the noise)

There's no question that at-source measures are by far the most effective, and it will be no surprise that they are the most cost-effective too. They are also the fairest, as the costs are paid by those who cause the noise rather than by the victims of noise.

The greatest reduction potential comes from technical measures to cut noise emissions from vehicles, road surfaces, and particularly tyres. Many engines and tyres already on the market give off noise levels well within current limits, which means noise reductions can be achieved at relatively low cost to the automotive industry.

What does x decibels mean?

Here's an approximate guide to the kind of sounds associated with a 10-140 decibel scale.

10 dB(A)	Breathing	85	Heavy traffic (standing next to a busy road)
20	Broadcasting studio	90	Shouting
30	Bedroom at night	100	Electric drill
40	Refrigerator	110	Car horn
50	Rainfall	120	Emergency siren
60	Normal conversation	130	Car racing
70	Washing machine	140	Plane taking off
80	Vacuum Cleaner		

EU legislation to limit noise

There has been an EU directive on vehicle noise since 1970, but it has not reduced noise from car traffic and only a tiny bit from lorry traffic. The reason is that the type approval limits never pushed the industry towards lowering existing noise levels; instead they just reflected the available technology of the time. In addition, the test conditions in which cars get their approval certificates are not representative of real driving conditions, and there is evidence that vehicles perform very differently on the road.

The last time vehicle noise limits were tightened was in 1995 – air pollution limits have been tightened three times in the same period! – and the European Commission has delayed the latest revision of its legislation by at least another year. It said in October 2007 that it would continue collecting data on vehicle noise until 2009-10, and would only then consider legislation to tighten existing standards. This means a minimum of three years before legislation for quieter vehicles can come into effect.

It took until 2001 for tyres to have their own legislation, but even that was very weak. When they were introduced, the tyre noise standards were easily met by almost all the tyres on the market. They should have been tightened in 2004, but the Commission has kept procrastinating, and its promise of draft legislation on tyre noise by the end of 2007 has also been broken.

Legislation on rail noise only came into effect at the start of the current decade, and even then only for trains operating in two or more member states. Noise limits are included in the railway interoperability directives for new and modernised vehicles in both high-speed and conventional rail, but they are easily met by existing technology. The real problem lies with the existing fleet. Rail rolling stock has a typical lifespan of up to forty years, so the vast majority of the current fleet dates from before the legislation and can be seriously noisy. There is considerable scope for improvement by retrofitting the existing rolling stock but the next reduction in rail noise limits is not foreseen until 2016-18, and even then the reduction envisaged is only 2-5 decibels.



European legislation on sources of noise:

Motor vehicle noise: Directive 70/157 and UN-ECE Regulation 51

Tyre/road noise: Directive 2001/43/EC

Rail vehicle noise: Directive 96/48/EC (high speed) and 2001/16/EC (conventional)

Scope for improvements

There is massive scope for improvements. In **road** traffic, current technologies for vehicles, tyres and road surfaces could – if backed up by proper standards – combine to make roads 5 decibels quieter (equal to reducing noise levels by 70%)¹. A reduction in the limit values of 5 decibels for tyres alone is feasible without compromising other aspects of tyre performance.

In **rail** traffic, regular polishing of railway tracks could bring about a noise reduction of up to 5 decibels, and replacing a train's cast-iron brake blocks with blocks made from composite materials could bring reductions of 8-10 decibels.

Any measures the EU takes will reduce the need for local measures, so the EU would help to ease pressure on the budgets of highway and local authorities. Certain types of brake blocks save so much on maintenance costs that they recoup their purchase price over their lifetime, so would effectively cost nothing. Yet still progress is painfully slow.

¹ Reduction Potential of Road Traffic Noise: A Pilot Study by Kropp, W et al (Chalmers University of Technology, Göteborg, 2007)

A history of inaction

The EU is committed in many of its policy documents to reducing noise (Environmental Action Programme, Sustainability Strategy, Common Transport Policy, etc) but the problem is that noise isn't recognised as a major environmental health issue.

The relative lack of action since the first noise standards were introduced 37 years ago can be largely attributed to the European Commission having continually allowed itself to be knocked off course by the uncooperative attitude of the affected industries. The Commission announced in mid-2007 that vehicle manufacturers should begin collecting data using a new test method for the next revision of the EU vehicle noise directive. Yet the manufacturers did not provide any data at all from the first months of testing using the new method alongside the traditional test (June-September 2007).



In fact, the EU could press ahead anyway rather than waiting unnecessarily for data that is not forthcoming. All the while, more cars are coming onto the EU's roads, many with wider (ie. noisier) tyres, all increasing the social misery and costs of traffic noise across Europe. And with the Commission still collecting its data for another two years, it's likely to be 2012 at the earliest before any new traffic noise standards enter into force, and another six years before the majority of cars on the roads have the quieter technology.

What T&E is recommending

A 70% reduction (5dB) in road noise is achievable *with current technology*. There is similar potential to reduce railway noise. But for both to happen, the EU must take a bold leading role. To encourage progress in this, the European Union must:

- ◀ introduce legislation (via its tyre noise directive revision) which reduces tyre noise limits to an effective level (71 decibel limit by 2012); and it must agree in principle even tighter standards to come into force in 2016 so tyre makers can get to work now
- ◀ take back responsibility for limiting vehicle noise (it has effectively handed it to the UN Economic Commission for Europe) and set stringent limit values by 2010
- ◀ introduce by 2010 a European product classification (CEN standard) for road surfaces based on their noise performance, and oblige public authorities to include noise specifications for the surface in road building contracts
- ◀ set noise emissions ceilings on railway tracks, in relation to land use and population density
- ◀ establish a framework for Member States to introduce noise-differentiated track access charges, which will create an incentive for fast and prioritised retrofitting of railway vehicles with quiet brake blocks
- ◀ Insist that type approval data for noise is made publicly available for vehicles, tyres, railway rolling stock, locomotives and aircraft.



These are all measures within the EU's legislative competence. But there are other things the EU can do, even on matters where final responsibility rests with governments or local authorities. These include:

- ◀ Raise awareness of traffic noise and its dangerous effects in administrations and general public.
- ◀ Set down a framework for the use of market-based instruments to ensure the polluters pay for the damage (perhaps related to EU initiatives on infrastructure charging)
- ◀ Offer help and funding to authorities to enforce the ban on illegal noisy exhausts on cars, motor-bikes, scooters and trucks

Case proven! Who could possibly object?

If only it were that simple. Among the arguments put forward against a significant tightening of existing noise standards are:

Let others act first ... solving the problem with at-source measures requires input from the tyre and rubber industries, the car makers, and the road construction and surfacing companies. But they all want someone else to be first to act: the tyre and rubber industries say surfaces and vehicles need to be regulated first, the car industry says tyres and surfaces need to change before any improvements to engine noise will contribute something worthwhile, while the road construction industry says tyres need to improve before surfaces can be made quieter!

Safety might be compromised ... the tyre and rubber industries say a reduction of more than three decibels is not possible without affecting safety and durability. This argument does not hold water, as the average noise level on the market is already 3.5 decibels below the current EU standard, and there are car tyres on the market that are 6 decibels quieter than current noise standards and also have above average safety (wet grip) performance.²

Tyres don't make noise on their own ... the tyre industry says road surfaces are the major cause of noise, because tyres don't make a noise on their own, only when they roll on a road, so the surface is to blame! Apart from its obvious silliness (road surfaces don't make a noise on their own either), this argument misses the point that having better tyres will make investment in quieter surfaces more cost-effective for local authorities, and is thus a win-win situation.

In step with the UN ... EU traffic noise standards have traditionally been linked with standards worked out at the United Nations' Economic Commission for Europe. It means the EU has effectively handed over responsibility for traffic noise to the UN-ECE, a body that works on the basis of consensus and whose working parties are dominated by the automotive industry; the industry in turn guards data on noise testing as if it were a security risk to release it. As a result, UN-ECE standards have never pushed the relevant industries to invest in better technology than is available anyway.

We need the long-standing interests of Europe's citizens – especially the vulnerable and less well-off – to take precedence over the often laughable arguments of industries which are looking only to protect themselves.

² Exterior noise, grip and rolling resistance levels of C1, C2 and C3 tyres in relation to the tyre noise directive (EU directive 2001/43/EC) and consumer interests by de Graaff, E and van Blokland, G (M&P Consulting Engineers, Vught, 2007)

- ◀ Noise from road and rail traffic – particularly road – is a source of several harmful impacts which make people's lives a misery and cost the European economy at least €40 billion per year
- ◀ EU legislation on traffic noise has existed since 1970 but is so weak that it has done nothing towards reducing noise levels alongside Europe's roads
- ◀ The European Commission says it will begin work on a new revision of the current vehicle noise directive in 2009

In this brochure, the European Federation for Transport and Environment (T&E) sets out the problem of traffic noise and what can be gained by seriously tackling it, and recommends the best courses of action for the EU to adopt in drafting a new set of tighter noise standards.



**European Federation for
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