

# QUIET PLEASE

Better health through strong EU regulation  
of road and rail traffic noise



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# TIME TO LISTEN – TIME TO ACT

Traffic noise is one of the most widespread environmental problems in Europe, with severe consequences for public health. According to recent findings from the World Health Organization (WHO), noise causes sleep disturbance, and increases the risk of high blood pressure and cardiovascular diseases. Other effects include greater annoyance, stress and the hindering of children's learning. Noise pollution interferes with people's quality of life and health and can even have fatal consequences. The environmental impact on health by noise is second only to that from air pollution.<sup>1</sup>

The WHO assessment of the burden of disease from noise confirms that traffic noise is a major cause of environmental health problems. In cities, and near main roads and railways, traffic is the major contributor to noise levels.

At present, some 210 million Europeans are regularly exposed to road traffic noise levels exceeding 55 decibels and 35 million are exposed to these levels of rail noise, according to recent studies.<sup>2</sup> Health impacts frequently occur above this level according to the WHO and the European Union (EU).

Europeans are keenly aware of the effects on health of noise, and are becoming increasingly concerned. A Eurobarometer survey published in 2010 showed that 44% of citizens consider that noise affects human health to a "great extent", a 5-point increase on a similar survey in 2006.<sup>3</sup>

And the problem is getting worse. As traffic increases, noise levels increase and people's ill health and quality of life worsens. The EU first legislated on vehicle noise over forty years ago but since then the problem has been neglected by policy makers.

There are several easy ways to make improvements, by focussing on noise reduction at the source. Reducing the noise emissions of vehicles is the most efficient and cost-effective way to tackle the problem, and provides benefits for people near to every road and railway in Europe. An alternative or complementary approach is to construct noise walls or to add sound insulation to buildings, which is often expensive for local authorities and achieves only very localised benefits.

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

Over the next two years, the EU policy makers have several opportunities to reduce traffic noise dramatically and thus to achieve real benefits for Europe's citizens:

- With most city noise emanating from the engines, exhausts and tyres of road vehicles, stricter vehicle noise standards will encourage car, van, bus and truck manufacturers to produce noticeably quieter vehicles. The European Commission is due to propose new vehicle noise emissions standards in 2011.
- Complaints about noise from trains, especially freight wagons, is a barrier to increasing the share of rail, which is a goal of EU Transport policy to reduce greenhouse gas emissions from the sector. The EU is starting work on new noise standards for trains and developing measures to promote the use of quieter wagons.

This brochure offers a tour of the problem, the latest scientific evidence and the solutions that can give us all quieter lives.



## WHEN SOUNDS BECOME THE PROBLEM OF NOISE

A certain level of sound is absolutely fine. But there comes a point at which sounds become uncomfortable or unwanted, and beyond that level we talk of noise. For every person, that point is different, and different sounds can be benign or malignant depending on circumstances. But noise is not only a question of individual perception: research from the World Health Organisation and other scientists shows the negative effects on our health of noise coming from road, rail, airports and from industrial sites, the so-called environmental noise.

Noise can therefore be characterised as audible sound that causes disturbance, impairment or health damage.<sup>4</sup> But effects can already occur at levels where we are not yet conscious of noise. In order to protect our health from the effects of environmental noise, WHO issued recommendations on limit values of average noise levels for specific places such as dwellings, schools, and hospitals. If the noise levels are above the recommended levels, exposed people are likely to experience negative effects on their health and wellbeing.

The WHO's burden of disease report from the Regional Office for Europe has warned that in the EU and Norway, traffic noise is the **second biggest environmental problem affecting health after air pollution**. Each year, Europeans lose at least one million healthy life years due to disability or disease caused by traffic noise - and the WHO considers this to be an underestimate of the real total.<sup>5,6</sup>

## HOW DOES NOISE AFFECT OUR HEALTH?

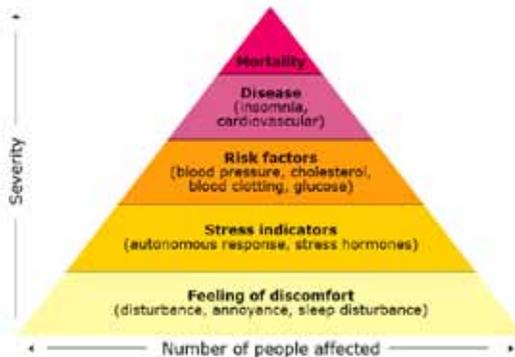
Noise pollution affects adult and child health and well-being both directly and indirectly. It affects our nervous and hormonal system, which can increase the risk of cardiovascular disease and damage to cognitive function.

Noise creates stress to which our body reacts, for example, with an increase in heart rate and blood pressure. These bodily reactions are not something that we can control or adapt to because we may not even be consciously aware of them. For example, the frequency of body movements during sleep increases at instantaneous sound levels as low as 33 decibels even though the noise may not wake us up.<sup>7</sup>

### Health effects of noise pollution can include:

- Sleep disturbance, including loss of sleep quality, and awakening. Disturbed sleep and tiredness can lead to loss of concentration, more accidents and injuries
- Disrupted learning, understanding and memory (especially in children)
- Annoyance, leading to stress and reduced quality of life
- Tinnitus
- Heart disease, including heart pressure attacks, and other problems as a result of raised blood pressure

Figure 1 Pyramid of effects (WHO 1972 — modified)



Source: EEA Good practice guide (2010)<sup>8</sup>

## NOISE CAN BE FATAL

A study by CE for T&E (2007) estimated that around 50,000 people in the European Union die prematurely each year from heart attacks caused by traffic noise. An additional almost 200,000 suffer from all types of cardiovascular disease linked to traffic noise.<sup>9</sup>

For people living in streets with average noise levels above 65-70dB(A), the average risk of heart disease is 20% higher than for people living in quieter streets. And while perceptions of noise problems can get better as people feel they are getting used to them, noise-related cardiovascular problems show no signs of improving with time.<sup>10</sup>

### Evidence from EU member states:

Strong scientific evidence exists for the impact of noise on heart disease. A study in **Germany** showed that each year traffic noise causes 1,629 non-fatal heart attacks. In the city of **Berlin**, 1.1% of all myocardial infarctions are attributable to road traffic noise.<sup>11</sup>

In **Greater London**, up to 108 heart attacks and nearly 500 cases of heart disease could be caused by prolonged exposure to high levels of road traffic noise.<sup>12</sup>

A new study from **Denmark** shows an increased risk for stroke from traffic noise. This is the first time researchers have identified such a link. Specifically, it shows that exposure to residential road traffic noise increases the risk of stroke among people over 64 years of age.<sup>13</sup>

The EU-funded HYENA study looked at the impact of aircraft and road traffic noise near **airports** on blood pressure. Data from over 5,000 persons was collected in six countries: Germany, Greece, Italy, the Netherlands, Sweden and the UK from around seven airports. The scientists found a link between the risk of hypertension and night-time aircraft noise. Exposure to 24-hour road traffic noise also increased blood pressure, particularly in men.<sup>14</sup>

In the **Netherlands**, nearly 2 million people are “highly disturbed” during sleep by road traffic noise. This estimate is based on surveys in which the population was asked about which sources impacted on their sleep.<sup>15</sup>

Sadly, it's the most vulnerable members of society – children, elderly people, and those already in poor health – who suffer most.

There is an issue of social equity too – homes in noisy areas tend to be cheaper (whereas those in quiet areas come at a premium), so people on low incomes are also likely to be at greater risk of harm to health from noise, and from the combined effects of air pollution.

## Protecting children’s health from noise pollution

Evidence is consolidating on the impact of road and aircraft noise on children, especially their learning capacities.

More than 20 studies show the negative impacts of noise on reading and memory in children:

The EU-funded research project, RANCH looked at the impact on children of noise from three European airports in the Netherlands, the UK and Spain. Researchers found a clear link between traffic noise and effects on reading comprehension and memory.<sup>16</sup>

Researchers studying the effects of noise from Munich airport found effects on children’s long-term memory and reading comprehension. When the airport was relocated, the children who had been exposed to the noise recovered. However, children living near the new airport quickly showed the same detrimental effects.<sup>17</sup>

Some guidance on children and noise exists. For example, the WHO indicates that classroom noise levels above 35 dB(A) on average can affect the child’s ability to understand what is being said by the teacher.<sup>18</sup>

Political decision-makers are to some extent aware of the problem of children’s special vulnerability to noise. In 2010, all EU Environment and Health ministers signed the “Parma Declaration” with its “Commitment to act” on the conclusions of the latest WHO Ministerial conference on environment and health. This commitment pledges ministers to reduce children’s exposure to noise and to offer their assistance to WHO for developing suitable guidelines on noise.<sup>19</sup>



While scientific evidence is increasing, many open questions on the health effects of noise still remain in relation to adult and child health. One example is whether children who are exposed to noise throughout their early years are particularly badly affected. These long-term effects on learning are still unknown. Thus, the impact on health from exposure to noise may be far greater than we imagine today. And researchers have only just begun to look at the combined effects on health from exposure to air pollution and noise.

However, there is enough scientific evidence to merit political action now. Ambitious policy measures should be taken, with a focus on reducing environmental noise at source, to prevent further disease and loss in the quality of life. For instance, specific health-based guideline values should be included in the upcoming revision of the EU directive on environmental noise.

## MEASURING NOISE

Noise is measured in decibels, but the decibel scale requires some explanation:

- **dB** - 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.
- **dB(A)** - The short form for decibels is generally dB but noise is often given in dB(A) units as it is in this report. The (A) is added to denote that the scale has been adapted for the human hearing range. Sounds that are louder than 120dB(A) – the level of noise when a military aircraft takes off – is the level where pain starts.

Researchers measure the noise levels in different intervals, for example looking at the daily minimum or maximum, or an average of the levels in a day, a month or a year. The EU Environmental Noise Directive defines two important indicators:

- **Lden** - Lden represents the average sound pressure levels over all days, evenings and nights in a year;
- **Lnight** - Lnight provides information on the average yearly night time level with measures over 8 hours.<sup>20</sup>

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 sound wave frequency (pitch), whether it's continuous or intermittent, how long it lasts, what time of day it occurs, 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 its buzzing is very disturbing.

## SCIENTIFICALLY RECOGNISED AND QUANTIFIABLE CONCEPTS

The terms “annoyance” and “sleep disturbance” may seem to some as just subjective judgements. 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. It can also lead to more accidents and injuries. 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 stress 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 dB(A), and people can be fully awakened from 53 dB(A).<sup>21</sup>

**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 shows that children’s concentration and school performance is affected.

**Heart disease** ... The recent WHO burden of disease report shows that sleep disturbance can also increase the risk of high blood pressure and cardiovascular disease. 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). Evidence is also emerging on an increased risk of stroke due to environmental noise.<sup>22</sup> Noise triggers the production of stress hormones like cortisol, noradrenaline and adrenaline, which is especially dangerous over long periods of exposure.

**Annoyance** ... In noise studies, the term annoyance is used to denote a measurable adverse human reaction when people are exposed to certain levels of sound. Annoyance is usually measured with the help of field studies, where people report their own reactions, coping mechanisms, and evaluation of the severity of the problem.

Annoyance is the most widespread problem created by noise, and in certain circumstances it can affect our behaviour being expressed by fear, uncertainty and anger. These responses can lead in turn to subconscious physical reactions, such as stress and raised blood pressure.<sup>23</sup>

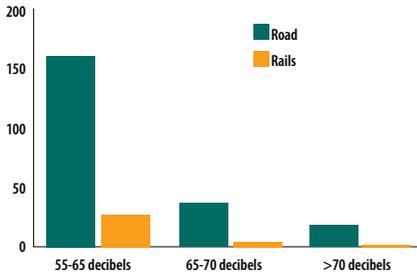
**Hearing impairment and tinnitus** ... It is well known from occupational health studies that high noise levels can cause hearing impairment and tinnitus. The symptoms are a constant high-pitched sound in the ears causing discomfort and affecting hearing.<sup>24</sup>

**Other problems** ... there are other problems too. Researchers are also looking into how noise affects mental health, but the evidence is not yet conclusive. However, in animals noise from traffic can disrupt the 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.<sup>25</sup>



## TRAFFIC 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 the most widespread source of environmental noise. Road traffic is by far the biggest culprit. Whilst car traffic is steadily increasing, especially in central and eastern Europe, the growth in freight transport throughout the EU is much faster, meaning that noisier vans and heavy trucks are comprising an ever-growing share, which adds to the increasing noise on our roads.

### How much noise exposure?

In the EU, around 210 million people are exposed to road traffic noise at levels exceeding 55 decibels.<sup>26</sup> This number represents the annual average noise level during the day and night. At night, around one in five of the urban population in the European Union are exposed to levels exceeding 55 decibels over an 8 hour period.<sup>27</sup>

## WHAT CAN BE GAINED BY TACKLING TRAFFIC NOISE?

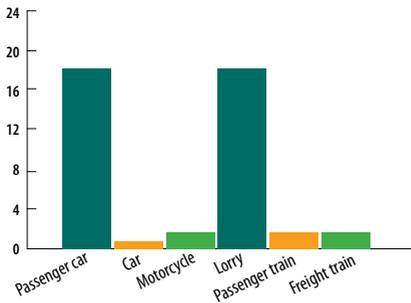
Reducing traffic noise across Europe will bring major economic benefits, among them:

- 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 learn better at school
- If noise is reduced at source, councils and highway authorities will need to spend less on anti-noise walls and insulation
- Property values near transport infrastructure will increase and the socially-harmful discrepancy in property values will be reduced.

## THE COST OF TRAFFIC NOISE

When noise has an impact on people's ability to function and on their health, there are costs to society and to healthcare budgets.

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.

A conservative estimate of **the social cost of traffic noise is €40 billion per year**, of which 90% is from cars and lorries. That represents a loss of 0.4% of total EU GDP each year - equivalent to about one-third of the societal cost of road accidents.<sup>28</sup>

This estimate is conservative, and excludes the latest WHO findings.

Estimates in a study for the UK government suggest that noise pollution produced costs, in England alone during 2008,

in excess of GBP9billion (around 11 billion EUR) including GBP5-9billion in annoyance costs, GBP2billion health costs and a further GBP2billion (around 2.5 billion EUR) of productivity losses.<sup>29</sup>

An EU study looking into the benefits of stricter new standards for vehicle noise has concluded that strict standards to produce an effect equivalent to that of halving traffic, would outweigh the costs of developing and introducing quieter vehicles by over twenty times!<sup>30</sup>

### Who pays?

In general, anyone who suffers the negative effects on their health, sleep or well-being carries the burden of the cost. Children appear to be more affected, and poorer people may be disproportionately affected because they tend to live in cheaper, noisier areas. In addition, taxpayers pick up the bill for increased health care costs or remedial interventions, such as the construction of noise walls or the insulation of buildings. Employers pay through lost work time and productivity.

## 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, quieter road surfaces, 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 (drivers, through higher vehicle prices) rather than by the victims of noise and taxpayers (people living in noisy environments, through taxes and charges to fund anti-propagation measures).

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

## EU LEGISLATION TO LIMIT NOISE

### European legislation on sources of noise:

**Motor vehicle noise:** Directive 70/157 and UN-ECE Regulation 51 – to be revised from 2011

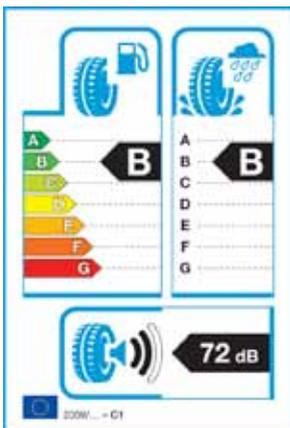
**Tyre/road noise:** Regulation 661/2009 (tyre noise standards) and Regulation 1222/2009 (tyre labelling) - both will enter into force in 2012

**Rail vehicle noise:** Directive 96/48/EC (high speed) and 2001/16/EC (conventional) – to be revised from 2011

Despite the existence of EU legislation on vehicle noise since 1970, the exposure of citizens to noise has not diminished since then. As traffic increases, people continue to be exposed to high levels of noise with consequences for health.

The reason is that the noise standards have never pushed the industry towards lowering existing noise levels; instead they just reflected the prevailing technology of the time. In addition, the test conditions in which cars obtain their approval certificates are not representative of real driving conditions. The revision starting in 2011 should make sure that the test is more relevant to real noise performance on the road.

The most recent tightening of vehicle noise limits took place in 1992. In 2011, the European Commission is due to finally present a proposal for new noise standards, for cars, vans, trucks and buses, which has been repeatedly delayed. As evidence of the serious health impacts of noise on over 200 million Europeans has become clearer, this opportunity must be used to make sure that traffic noise is reduced to the levels recommended by the WHO to protect health. The new standards must be introduced as a matter of urgency because it will take several years for the new legislation to be fully effective and for quieter vehicles to become a substantial share of the fleet.



The standards for noise from tyres were updated in 2009 but they are far from adequate. However a labelling system was agreed to give consumers, fleet managers and public authorities an opportunity to choose between tyres that are the best and worst performers. The labels will be on all tyres for sale in Europe (cars, vans, trucks and buses) from 2012.

Legislation on rail noise only came into effect at the start of the last 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 very noisy. There is considerable scope for improvement by retrofitting the existing rolling stock, which should be encouraged by putting charges on noisy carriages, and giving bonuses for quieter wagons.

## 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 10 decibels quieter.<sup>31</sup> This is equivalent to reducing the perceived noise level next to a busy road by half.

Vehicles alone can easily be 6 decibels quieter than today, if only effective standards are set.

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. 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.

## 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, and so on) but the problem is that noise has not been properly recognised as a major environment and public health issue.

The relative lack of action since the first noise standards were introduced over forty years ago can be largely attributed to the European Commission having allowed itself to be knocked off course by the uncooperative attitude of the affected industries.

Any measures the EU takes will reduce the need for local measures, so the EU would help to ease pressure on the budgets of local authorities, city councils and road authorities, who are also calling for stricter European standards.

More importantly, health, quality of life and human productivity would benefit, including improvements in cardiovascular health and child development. Ultimately, noise reduction would also result in cost reductions in the health sector.

## WHAT DO T&E AND HEAL RECOMMEND?

A 10-decibel reduction from road noise is achievable with current technology.<sup>19</sup> There is similar potential to reduce railway noise. But for both to happen, the EU must take a bold leading role. To achieve this, the European Commission, with support from the European Parliament and Member States, must:

- **Introduce effective noise emissions limits** for cars, vans, trucks and buses by 2013. These should be set at such a level as to achieve an overall noise benefit equivalent to halving the traffic noise. They should also outline the steps for further tightening of the standards to 2020.
- **Introduce labels** indicating to consumers and public authorities which vehicles are the best and worst noise performers (as is now required for tyres). The objective is to raise awareness and as a basis for incentives, such as procurement standards or to gain access to low-emissions zones
- **Set noise emissions** ceilings on railway tracks, in relation to land use and population density
- **Establish a binding framework** for the use of market-based instruments to ensure the polluters pay for their noise costs, including road charges and a framework for rail track access charges, which will create an incentive for fast and prioritised retrofitting of rail wagons with quiet brake blocks.
- Revise the **noise standards** for new railway rolling stock (TSI Noise).
- Insist that **type approval data** for noise is made publicly available for vehicles, tyres, railway rolling stock, locomotives and aircraft
- **Introduce by 2013 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.

The EU can also take action in other areas, and encourage governments or local authorities to take complementary measures, for example:

- Raise awareness of traffic noise and its dangerous effects in government departments, especially with Ministries of transport, health and environment, as well as with the general public.
- Promote sustainable transport which will help reduce noise, but also produces benefits for air quality and the mitigation of climate change. By encouraging more public transport, walking and cycling, further health benefits in the population can be reaped.
- Integrate noise concerns into all relevant policy files and initiatives, such as a future 7th EU Environment Action Programme, a 2nd EU Action Plan on Environment and Health, under the “health in all policies” approach and health inequalities, but also in sustainable transport initiatives under the EU regional development programmes.
- Ensure that adequate finances are being allocated to broaden the evidence base on health impacts from traffic noise in the 8th EU Research Framework programme.



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- <sup>31</sup> W. Kropp, Kihlman et al. (2007): Reduction potential of road traffic noise", Royal Swedish Academy of Engineering Sciences: [www.iva.se/templates/page.aspx?id=4354](http://www.iva.se/templates/page.aspx?id=4354)

- Traffic noise affects people's health, well-being and quality of life in many ways by causing stress, learning problems, and heart disease. This noise pollution is a critical public health problem, to which over 200 million EU citizens are exposed, which costs the European economy at least EUR40 billion per year
- EU legislation on traffic noise has existed since 1970 but has been too weak to achieve any noise reduction for those living in European cities or alongside Europe's roads. Traffic has got louder.
- The forthcoming proposal to reduce vehicle noise should take ambitious steps for people's health and the environment. EU research shows the benefits of stricter new standards on vehicle noise would outweigh the costs of developing and introducing quieter vehicles by over twenty times.

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



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