European Commission

LOW NOISE ROAD SURFACES

Challenges and solutions brought by *Life* and other EU Programmes

Road traffic remains the top source of noise pollution in Europe* with noise levels projected to rise in both urban and rural areas over the next decade due to urban growth and increased demand for mobility.

To mitigate this effect, the Environmental Noise Directive (2002/49/EC) requests that European Union Member States develop action plans for major transport modes and the largest urban areas every five years based on the results of previous noise mapping results. The data submitted by Member States up to January 2020 shows that improving road surfaces is a widely reported mitigation measure for traffic noise within urban areas.

Low noise road surfaces, which are designed to reduce the amount of noise generated by vehicle traffic, are one of the most frequently mentioned solutions. These surfaces typically consist of materials that absorb or dampen sound waves, resulting in lower levels of noise pollution in surrounding areas.

LIFE and other EU Programmes have funded and continue to fund numerous projects to promote better road surfaces and their widescale uptake.

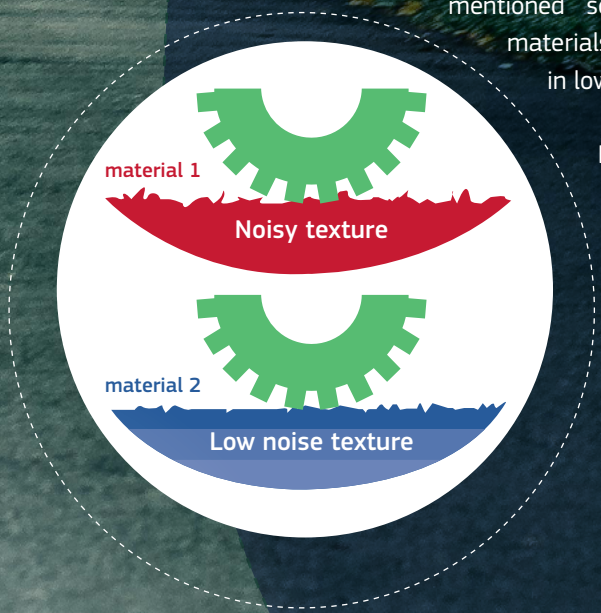

Figure 1. The texture and the material of a road surface are two key factors determining its noise level

*European Environment Agency

NATURA 2000

REDUCING NOISE LEVELS

At speeds over 30 km/h, rolling noise from tyres is the main source of noise from passenger cars, including fully electric vehicles, and for speeds over 60 km/h, it is the main source from heavy duty vehicles. Therefore, low noise surfaces are essential for reducing noise levels both in urban environments and on major roads.

In many European urban areas, such as Copenhagen, Rome, Paris, Stockholm and Geneva, low noise surfaces are increasingly being used on streets. Although low noise surfaces are successfully used on major roads in countries like Germany, France, Italy, Austria, Switzerland and others, the Netherlands stands out as the one where they are particularly prominent, since they cover almost 90% of main roads, totalling 6 600 km in length.

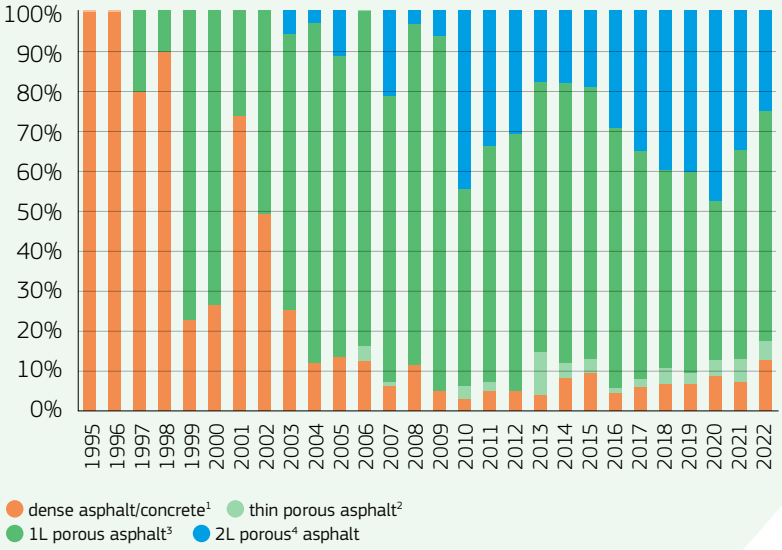

Figure 2. Road surfaces on Dutch motorways

AVAILABLE TECHNOLOGIES

There are several types of low noise surfaces and their application is mainly determined by the level of noise reduction, traffic volume and driving speed, durability, maintenance, costs, as well as climate and weather conditions. The following types of low noise surfaces are the most commonly used: double layer, thin surface layers, stone mastic asphalt and porous asphalt.

In recent years, various projects such as NEMO, LIFE COOL & LOW NOISE ASPHALT and LIFE SILENT have been developing and testing new types of low noise surfaces, considering various additional factors like the use of recycled products and thermal properties.

Figure 3. Different types of low noise surface used in the Netherlands

1 Dense graded asphalt or Asphaltic Concrete is a continuously graded mixture of coarse and fine aggregates, mineral filler and bitumen, produced hot in a mixing plant. It is delivered, laid and compacted while hot.

2 A thin layer of porous asphalt, which consists of standard bituminous asphalt in which the small-grain-size fraction has been screened and reduced, creating void spaces to make it highly permeable to water. The void of porous asphalt is approximately 16%, as opposed to two to three percent for conventional asphalt.

3 Single layer porous asphalt

4 Double layer porous asphalt. The top layer with a grain size 4/8 mm is about 25 mm thick and the second/bottom layer is porous asphalt with course aggregate (11/16 mm). The total thickness is about 70 mm. Because of the finer texture at the top (that gives less tyre vibrations), it gives a better noise reduction than a single layer porous asphalt

Figure 4. Projects focused on the development of low noise surfaces over the past 20 years

ACOUSTIC EFFECTIVENESS

Low noise surfaces can vary in their acoustic effectiveness depending on factors such as material composition, texture and design. Over the course of their lifespan, there is an average noise reduction of 2 to 6 decibels. Acoustic effectiveness of low noise surfaces is evaluated through field measurements and laboratory testing, including sound absorption tests, sound intensity measurements and subjective assessments of noise reduction via resident surveys. Additionally, standards and regulations may specify minimum acoustic performance requirements for low noise surfaces in different environments.

ACOUSTIC MEASUREMENTS

3-YEAR OBJECTIVE

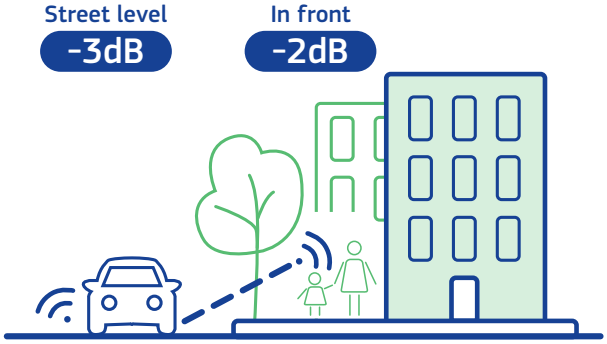

Figure 5. Acoustic measurements in Paris during LIFE COOL & LOW NOISE ASPHALT project

DURABILITY AND LIFESPAN

The durability of low noise surfaces refers to their ability to withstand the wear and tear associated with traffic, weather and other environmental factors over time while maintaining their performance characteristics, and especially their noise reduction properties. Durability is a key factor in maximising the benefit/cost ratio because more durable roadways require less maintenance and have a longer lifespan.

According to the results of research and acoustic monitoring of low noise surfaces, the lifespan of these surfaces ranges from 8 to 12 years, depending on the type, compared to an average lifespan of «noisy» asphalt roads which varies from 15 to 20 years, or to concrete roads which last around 20 to 40 years.

CO-BENEFITS

Low noise surfaces also bring multiple co-benefits, notably less air pollution (a smoother surface means lower vehicle emissions), increased safety and satisfaction of the local population.

MAINTENANCE

Maintenance of low noise road surfaces is crucial to ensure their ongoing effectiveness in reducing noise levels and to extend their lifespan. Although the maintenance of conventional and low noise road surfaces is similar, and includes crack sealing, pothole repair, surface patching, resurfacing, and so on, the maintenance of quiet road surfaces also involves porous surface cleaning, surface treatments, as well as acoustic monitoring. Additionally, repairs on quiet road surfaces must maintain the noise reduction characteristics, often requiring different materials and methods to conventional surfaces.

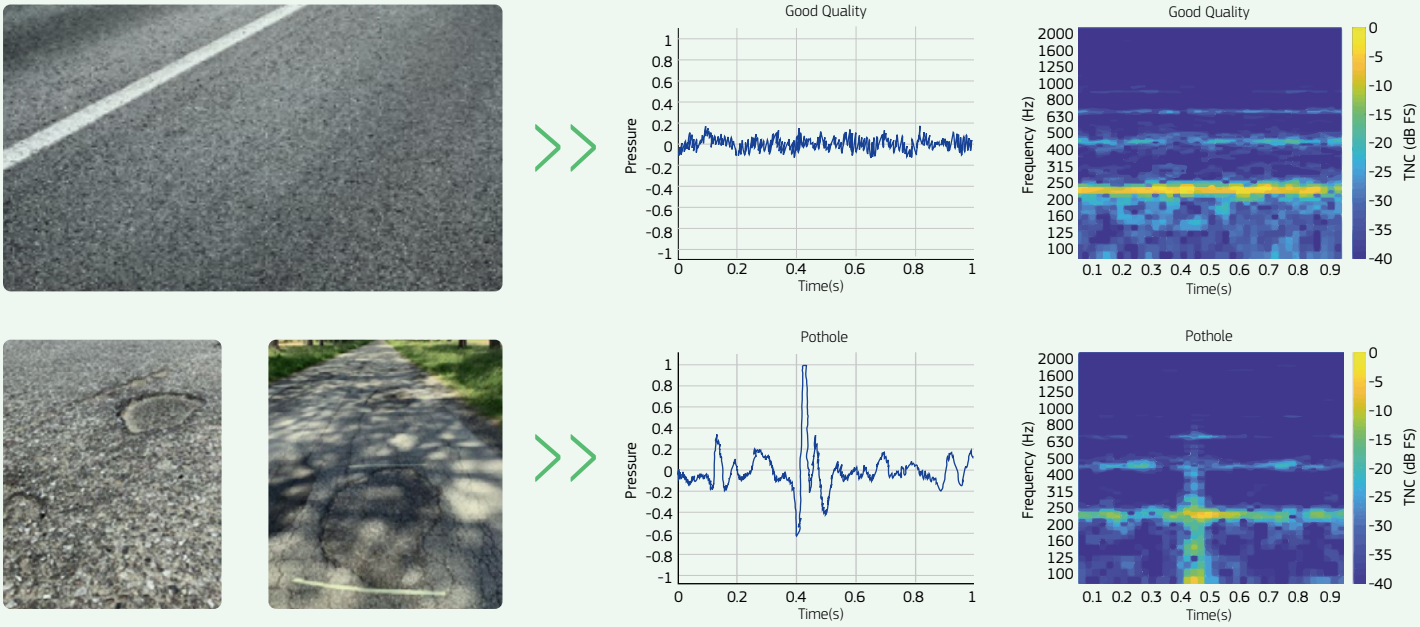

Figure 6. Cavities in roads lead to increased noise levels, which are maximised at the time of impact of the tyre with the cavity borders. The graphs show the impact peak and the related increase in air pressure (left) as well as the amplitude of the associated spectrum of sound waves linked to the noise (right), in both case as a factor of time.

EU POLICY, STANDARDISATION & NEXT STEPS

Low noise road surfaces have been used for decades in Europe, without the presence of a standard to be able to effectively compare them.

As one of the steps towards unified terms of reference for procurement, the European Union's Green Public Procurement guidelines specify requirements for evaluating the performance of low noise surfaces after construction, before road opening and a few months afterwards[5].

On 6 February 2024, the European Climate, Infrastructure and Environment Executive Agency (CINEA) and the Directorate General for Environment (DG ENV) of the European Commission organised an online network and awareness meeting, focusing on low noise surfaces, during which standardisation was discussed. Participants identified five areas where standardisation is mostly needed. They confirmed the urgent need to (in order of relevance):

1. develop standardised methods for the long-term performance of surfaces;
2. have a common designation of the surfaces;
3. define emission parameters for noise mapping depending on the low noise surfaces;
4. standardise the cost-benefit analysis;
5. propose common tender specifications for public authorities responsible for roads.

5 Joint Research Centre (JRC), Institute for Prospective Technological Studies, R. Rodriguez Quintero, S. Donatello, O. Wolf. Revision of Green Public Procurement Criteria for Road Design, Construction and Maintenance: Procurement Practice Guidance Document, 2016. Retrieved online from https://data.europa.eu/doi/10.2791/201271

PDF HZ-09-24-687-EN-N ISBN: 978-92-9405-128-8 DOI: 10.2926/179556