COOL + & LOW NOISE ASPHALT PROJECT

LET'S INNOVATE TODAY TO IMPROVE TOMORROW'S PARISIANS LIFE

LIFE project - co-financed by the European Union and implemented by the City of Paris, Bruitparif and the COLAS and EUROVIA companies.











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COOL & LOW NOISE ASPHALT DEPL



(2.)) 37 M Europeans

11 % of Parisians exposed to high noise levels

O1 THE CONTEXT: THE ENVIRONMENTAL ISSUES IN BIG CITIES

ALL OVER EUROPE, BIG CITIES SHARE THE SAME FINDINGS: SUMMER HEAT AND TRAFFIC NOISE ARE NUISANCES WITH MAJOR CONSEQUENCES ON THE CITIZENS HEALTH

The first responsible is road traffic noise: 37 million Europeans are exposed to noise levels that are harmful¹. Noise is the second environmental risk factor in Europe, behind air pollution. The sound environment is a major public health problem: discomfort and concentration disturbances, sleep disturbances and cardiovascular risks are tangible consequences.

In Paris, 11% of inhabitants withstand sound levels above the regulatory limit of 68 dB, especially on the major Parisian urban axes which concentrate most of the most exposed housing.

+8°C by 2100 Even at speeds between 30 and 50 km / h, the noise emitted by the rolling of the tires on the road surface exceeds that produced by the engine.

Another major nuisance for city dwellers: heat waves. IPCC studies show that the intensity and duration of these phenomena will increase, affecting more urban areas. In question: the phenomenon of Urban Heat Island (UHI) by which mineral and impermeable surfaces restore, at night, the energy accumulated during the day. Result: during episodes of high heat, city dwellers endure night temperatures that are significantly higher than those in natural vegetated environments. Therefore, UHI represents a new public health issue..

Assessment of the exposure of populations

to transport noise in Europe - December 2014

- European Environment Agency (EEA).

02 ONE ANSWER: THE LIFE COOL & LOW NOISE ASPHALT PROJECT

INNOVATION LEVERS AT EUROPEAN AND PARISIAN LEVELS

Faced with the major urban environmental and health challenges of noise and heat, European cities are implementing many solutions, acting on several levers: encouraging electric motorization, revegetation, sprinkling water on the roadways, but also improvement the properties of the materials.

The City of Paris is pursuing a policy against atmospheric pollution and reducing noise pollution thanks to its regional Climate Air Energy Plan, its Environmental Noise Prevention Plan and its Resilience Strategy. Thus, it transforms public space to adapt the city to the challenges of the 21st century and contribute to improving the living environment.

By designing new mixes that are both phonic and thermal, the LIFE COOL & LOW NOISE ASPHALT project offers a concrete solution for a real and lasting improvement in the well-being of city dwellers alongside other levers. This is why this project has found an echo in the LIFE program, the European Union's financial instrument to support projects in the fields of environment and climate. LIFE responds to the European desire to fight against noise pollution and global warming by supporting initiatives. Europe plays an important role in these areas through several major directives such as the limitation of admissible sound levels for motor vehicles.

INNOVATIVE MATERIALS TO FIGHT AGAINST NOISE AND HEAT IN CITY

The LIFE COOL & LOW NOISE ASPHALT project deploys 3 innovative bituminous road surfacing formulas. They aim to improve the phonic and thermal properties of more traditional asphalt mixes to reduce noise pollution and the effects of global warming. This is the first European project to research asphalt solutions that simultaneously have better noise and heat protection performance.

The experiment must also meet an objective of economic performance: the expected final production overhead compared to conventional coatings is less than 10%. To achieve this goal, innovative materials are produced from existing manufacturing technologies and employ products available in today's market.

The ambition of the LIFE COOL & LOW NOISE ASPHALT project is to replicate, if successful, the operation on the scale of the Parisian territory, but also on a national and European scale.



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PARIS

It leads a proactive policy of sustainable development, set out in the Plan for the Prevention of Noise in the Environment (PPBE), the adaptation strategy of the Climate Air Energy Territorial Plan (PCAET) and the Master Plan for uses and the network of non-drinkable water. The LIFE COOL & LOW NOISE ASPHALT project is supported by several departments working together:

- > The Green Spaces and Environment Department (DEVE) of which the Urban Ecology Agency (AEU) is part, which is piloting the project.
- > The Roads and Transportation Department (DVD) with, for implementation, the Public Space Laboratory (LEP) and the North-West and South-West Territorial Sections of Roads (STV) (8th and 15th arrondissements).
- > The Department of Cleanliness and Water (DPE) and its Technical **Department for Water and Sanitation** (STEA) for the non-potable water sprinkler component of the roadway.
- > The Finance and Purchasing Department (DFA) as a support service for the financial arrangement of the project.





The LIFE program is the European Commission's financial instrument to support projects in the fields of environment and climate. It is aimed at promoters of public and private projects and aims to promote and finance pilot projects, demonstration projects, the establishment of good practices in new territories, communication and awareness initiatives in the various fields of environment and climate. For the period 2014-2020, the LIFE program has a budget of over 3 billion euros at European level. The LIFE COOL & LOW NOISE ASPHALT project is the winner of the 2016 LIFE call for projects.

Controlled costs These innovative and resistant coatings will result in an additional production cost limited to 10%.



invested, including € 1.3 million in European funding.



1st international asphalt experiment project

with simultaneous noise and heat protection performance.

THE PROJECT TIMETABLE

- > Project duration: 5 years (July 2017-July 2022)
- > Assessments: until 2027
- > Work sites laying experienced coatings: September-October 2018

PUBLIC-PRIVATE COLLABORATION AND EUROPEAN FUNDING

The City of Paris is leading this project, the result of a virtuous partnership with Colas companies, Eurovia and the Center for Technical Assessment of the Sound Environment in Île-de-France Bruitparif. Université de Paris (LIED laboratory) is also helping to ensure the success of the project as part of a CIFRE thesis.

The LIFE COOL & LOW NOISE ASPHALT project was awarded the European LIFE program in 2016 and receives funding from the European Commission of around 1.3 M euros (including almost 700,000 euros for the City of Paris).

COSTA

PARISIENNE DU CLIMAT

> The Stakeholders Committee guarantees wide dissemination of the results and intervenes alongside the project partners on issues related to the dissemination and replicability of the results. The COSTA participates among others: Acoucité, ADEME Île-de-France, Agence Parisienne du Climat, Bruxelles Environnement, Eurocities Working Group Noise, Métropole du Grand Paris, ONERC, the cities of Florence, Madrid, Rueil-Malmaison and Turin.

This Scientific Committee is made up of technical and scientific experts responsible for giving opinions, advice and recommendations falling within their competence. This committee guarantees the interest and appropriation of the knowledge generated by the project for the benefit of the scientific and technical community. The COSCI participate, among others: Belgian Road Research Center, CEREMA of Nantes, the National Council of Noise, IDRRIM, IFSTTAR, Météo France, Université de Paris.

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Rue Frémicourt (15th)





Thermal measurement - July 2018 💋

Rue Lecourbe (15th)



Thermal measurement - July 2018 🌌

LDen noise level (24 hours) < 45 dB (A) 45 - 50 dB (A) 50 - 55 dB (A) 55 - 60 dB (A) 60 - 65 dB (A) 65 - 70 dB (A) < 18°C 70 - 75 dB (A) >75 dB (A)

Level of urban heat islands > 23°C 22°C - 23°C 21°C - 22°C

20°C - 21°C 19°C - 20°C 18°C - 19°C



pilot sites

- > streets at least 400 meters long with a moderate drop, > the presence of a connection to the non-potable water network,
- > the absence of construction in the surroundings, or the monitoring their potential impact.

On each site, around 200 meters of innovative paving were laid alongside the traditional paving (see page 13). In total, the project provides for the laying of 600 meters of pavement and directly concerns 1,000 Parisians.

innovative coatings



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The 3 chosen pilot sites are: > rue de Courcelles (8th arrondissement),

3 PARISIAN PILOT SITES

- > rue Frémicourt (15th arrondissement).
- > rue Lecourbe (15th arrondissement).

The combined criteria that determined the choice of these sites, located on the public domain of the City of Paris are:

- > high residential density,
- > noise level greater than 68 dB,
- > exposure to the sun,
- > virtual absence vegetation,
- > the speed of circulation
- limited to 50 km / h,



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O3 THE TECHNICAL SOLUTIONS DEVELOPED BY EUROVIA AND COLAS

3 INNOVATIVE COATINGS RESULTING FROM THE SYNERGY BETWEEN COMPANIES AND THE COMMUNITY

The EUROVIA and COLAS companies have developed three innovative bituminous road surfacing formulas: two compacted asphalt and one hot poured asphalt. They aim to improve the sound and thermal properties of conventional mixes, while ensuring good mechanical properties. Their common points:

- > the use of clear aggregates allows light to be reflected (albedo effect) and contributes to the reduction of Urban Heat Islands (UHI);
- the porosity of the aggregates results in greater water retention and promotes its evaporation, thus refreshing the air during heatwave episodes;
- > porosity is also an asset against noise pollution because it allows rolling noise to be trapped.

THERMAL PROPERTIES

The color of the coating is lighter on wear or after treatment, which increases its albedo: the lighter the materials, the more they reflect light and the less they absorb heat, so the less they release it during the night. During a heat wave, the sprinkling of water on the asphalt will accentuate this effect.

SOUND PROPERTIES

Unlike an ordinary coating, the surface of the coatings used is not smooth but porous and consists of micro-interstices that will trap the sound waves resulting from rolling noise, engines and other noise sources in the street.

DCUS

ON THE 3 FORMULATIONS

SMAphon[®] : URBAN ASPHALT WITH LIGHT AGGREGATES - BY COLAS

All SMAphon® formulations have been studied with clear Montebourg aggregates. The SMAphon® F9 formula was chosen because of the more homogeneous surface appearance and a lower proportion of 6/10 aggregates. It reduces the emission of tire / road contact noise.

Its phonic qualities have been improved by reducing the size of the aggregates that compose it. Objective: reduce vehicle rolling noise and improve sound absorption by 20%. SMAphon[®] also has very clear aggregates and water retention characteristics to limit the heating of the pavement under solar radiation.



PUMA[®] : HOT CAST LIGHT AGGREGATE ASPHALT BY EUROVIA

All PUMA® formulations (Porous urban mastic asphalt) have been studied with clear Chailloué aggregates and a more specific 5/8 Granusil® cut. The F10 formula was chosen because it presents the best compromise between thermal, mechanical and financial aspects. The porous aggregate retained is ultimately pozzolan which has a real economic advantage over Granulex® (light aggregate composed of slate expanded under the effect of heat), the disadvantage of which in terms of clarity has been compensated for by the addition of 14% of Granusil® (calcined ground silica).

UROVIA

PUMA® offers innovative sound and thermal performance while maintaining important mechanical and durability characteristics. The acoustic benefit of the porosity of its lightweight aggregates is enhanced by the use of pozzolan. Once implemented, a surface treatment by shot blasting is necessary in order to bring out the clear and porous aggregates on the surface.

BBphon+[®] : ACOUSTIC ASPHALT WITH LIGHT AGGREGATES - BY COLAS

As for SMAphon[®], all formulations were studied with clear aggregates from Montebourg. The BBphon+[®] F16 formula was chosen because it presents the best results in terms of mechanical resistance and acoustic properties, at the thickness of application.

Specially intended for built-up areas, this coating is modified to resist the attacks generated by traffic in urban areas: parking, intersections, mechanical cleaning, etc. BBphon+[®] has a water retention capacity and contains very clear aggregates to contribute to limit urban heat islands.



© Eurovia



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COLAS

A subsidiary of the Bouygues group, Colas is a world leader in road construction. Its mission is to promote transport infrastructure solutions for responsible mobility. In order to reduce noise pollution from road traffic, the Group has been developing the latest generation of acoustic mixes for many years. In 2012, Colas experimented with noise-reduction coatings on the Paris ring road, in partnership with Bruitparif: the HARMONICA project. To help preserve the environment, researchers at Colas' Scientific and Technical Campus, the world's leading private R&D center dedicated to roads, have also developed solutions allowing the reuse of milling from old pavements in place and cold, to lower the production temperature of the mixes or even incorporating components of plant origin. Partner of the LIFE COOL & LOW NOISE ASPHALT project, the Group has developed two innovative asphalt mixes which considerably reduce the noise emitted by traffic: BBphon+® and SMAphon[®].

A subsidiary of VINCI, Eurovia is one of the main global players in the construction of transport infrastructure and industrial, commercial and urban developments. Sustainable development and the environment are at the heart of its innovation policy: more than 70% of its R&D budget is devoted to the design of technologies and solutions intended for the environmental performance of infrastructures. Since its creation in 2004, the Eurovia International Research Center has filed more than 130 patents. It has developed around fifty products and processes that improve the carbon footprint of road activity, particularly in the field of warm asphalt and in situ pavement recycling. The entire Eurovia technical network, made up of the delegations and country laboratories, is also part of this logic by making the link between innovations, the reality of work sites and customer expectations. Upstream of worksites, circular economy solutions developed by Eurovia's network of guarries and industrial sites promote local production and transport loops. They also help to preserve the natural mineral resource by increasing the proportion of materials resulting from recycling. To save resources, Eurovia is already using recycled materials resulting from deconstruction - for the construction of new infrastructures. As part of the LIFE COOL & LOW NOISE ASPHALT project, Eurovia has developed a PUMA® hot mastic asphalt.

04 EXPECTED RESULTS: REAL AND LASTING BENEFITS FOR PARISIANS

DIRECT EFFECTS OF IMPROVING QUALITY OF LIFE

The objective of the LIFE COOL & LOW NOISE ASPHALT project is to reduce the temperature and noise pollution in streets and building facades to improve the well-being of residents. Indeed, several studies show that by lowering the sound level by a few decibels, the quality of sleep improves significantly and cardiovascular risks are also reduced. The drop in temperature in summer reduces respiratory and heart problems. These direct benefits are expected for the 1,000 Parisians affected by the 3 pilot sites and could be extended to all if the project is developed at city level.

CONCRETE AND NUMBERED OBJECTIVES AFTER 3 YEARS







A more serene living environment

A quieter and more temperate city favors the use of soft modes of transportation.

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Preserving health A few decibels less improve sleep quality

GLOBAL PERFORMANCE

GLOBAL PERFORMANCE	GOALS			
INDICATORS	2018 - just after installation	2021 - last measurement campaign before the end of the project	2027 - 5 years after the end of the project	
Sound performance				
Decrease in rolling noise (Lr) compared to the existing (Lri)	<=-5 dB(A)	<=-3 dB(A)	<=-1 dB(A)	
Decrease in rolling noise (Lr) compared to the reference surface (ref)	<=-3 dB(A)	<=-2 dB(A)	<=-1 dB(A)	
Reduction in facade noise (Lf) from residents compared to the existing (Lfi)	<=-3 dB(A)	<=-2 dB(A)	<=-1 dB(A)	
Reduction in facade noise (Lf) from residents compared to the reference coating (ref)	<=-2 dB(A)	<=-1 dB(A)	<=-0,5 dB(A)	
Thermal performance (variations depending on climatic o	onditions)			
Decrease in air temperature at a height of 1.5 m (pedestrian height) thanks to watering compared to the existing dry road	-1,5 to -2,5°C	-0,5 to -1,5°C	-1,5 to -2,5°C	
Temperature reduction felt at a height of 1.5 m (pedestrian height) thanks to the watering compared to the existing dry pavement	-2,5 to -3,5°C	-1,5 to -2,5°C	-2,5 to -3,5°C	
Decrease in air temperature at a height of 1.5 m (pedestrian height) in summer by albedo effect compared to the existing one and the reference coating	-1to -2°C	-1 to -3°C	-1 to -2°C	
Decrease in temperature felt at a height of 1.5 m (pedestrian height) in summer by albedo effect compared to the existing and the reference coating	-2 to -3°C	-2 to -4°C	-2 to -3°C	
Physical and geometric durability (micro-roughness and r	macro-roughness)			
	VEP > 65	VEP > 50	VEP > 65	
SMA and BB phonic asphalt	PMT > 1,4	PMT > 1,0	PMT > 1,4	
	VEP > 65	VEP > 50	VEP > 65	
Poured asphalt	PMT > 0,7	PMT > 0,5	PMT > 0,7	
Other indicators				
Energy saving Reduction of the reflection coefficient of pilot coatings	-10%	-10%	-10%	
Water consumption varies according to various factors that are difficult to quantify before setting up the field experiment (duration of sunshine of the roadway during the day, street orientation, type of coating, ground / air temperature, shading etc.)	22L/m ² /year	22L/m ² /year	22L/m²/year	

05 EVALUATION MEASURES: THE PERFORMANCE STUDY



EVALUATION AT THE HEART OF THE PROJECT

Throughout the project, and until 2027, evaluations will assess the impact of the devices on noise reduction and thermal performance. When triggering watering during "hot days" (high pressure summer days), data processing will focus on a comparison of the impact of albedo between areas with and without watering. Additional laboratory tests will allow the thermal performance of the coatings to be compared with each other. All measuring stations are installed for at least 5 years to assess the effects of aging of coatings.

The mechanical performance of the materials and its evolution, as well as an economic analysis concerning the cost of use and maintenance of asphalt, will make it possible to assess in the medium term the cost of solutions with regard to conventional asphalt, and to define

profitability. of the investment in order to be able to promote its replicability. Finally, a social analysis will quantify the improvement in the quality of life, the state of health of residents, the improvement of public space and the increased attraction for soft mobility.

Two expert committees, COSCI and COSTA (see page 6), support the project stakeholders and guarantee the dissemination of the results to the stakeholders concerned, as well as the replicability of this pilot project.

EFFICIENT MEASUREMENT

Measuring devices are set up for each of the pilot sites, both on a reference coating area (control area) and on an area containing the innovative coating. In order to collect the data used for the assessment, each pilot site is equipped with:

- 2 acoustic measurement stations (near a building facade, equivalent to the 1st floor). In addition, audioconforming sound recordings are taken on each board before and after work with a class 1 sound level meter (maximum precision);
- > 2 weather stations installed on the sidewalk at pedestrian height (i.e. 1.5 m in height) and 2 thermal sensors placed directly in the roadway (5 cm deep). Data transfer takes place in real time and is validated daily (marking specific weather events for example).





Or

Orange



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The LIED laboratory (Interdisciplinary Laboratory for Energies of Tomorrow) collaborates to the success of the project, as part of a CIFRE thesis (Industrial Convention for Training through Research) followed by the DVD and the DPE of the City of Paris.

BRUITPARIF

Bruitparif, the technical assessment center for the sound environment in Île-de-France, fulfills three missions of general interest: observation, support for stakeholders in taking noise into account in public policies and making everyone aware of the sound environment. Bruitparif also brings its expertise in experimenting with innovative actions to reduce urban noise. As such, Bruitparif is an associate partner of the LIFE COOL & LOW NOISE ASPHALT project. The organization is responsible for evaluating the solutions developed by the Colas and Eurovia companies through the deployment of a measurement tool system. Bruitparif coordinates the collection and processing of monitoring indicators in order to determine the environmental benefits (reduction in noise and the urban heat island - ICU) and associated socio-economic benefits (improvement in quality of life, health and social impacts, real estate valuation...).

AIROPTIC

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GLOSSARY

Acoustic asphalt: pavement in asphalt mix with improved acoustic performance.

Aggregate: set of inert materials (sand, gravel, etc.) used in the composition of mortars, concrete, mixes and asphalts.

Bituminous mix - Bituminous coating asphalt or "asphalt" in English: it's a type of surface layer (also called pavement coating) composed of aggregates and a bituminous binder. The asphalt is poured in place while the asphalt is compacted.

projecting microbeads on a surface to modify its surface structure, to strip it or to clean it. Albedo : reflection of light, solar reflection



capacity, reflective power of a surface. This reflection depends on the color and

the material of the surface.

Fraction absorbed by the surface **Urban Heat Island (ICU):** a heat island is characterized by a higher surface or air temperature in an urban area than in its periphery.

Shot blasting: technique consisting in





To find out more: www.life-asphalt.eu