

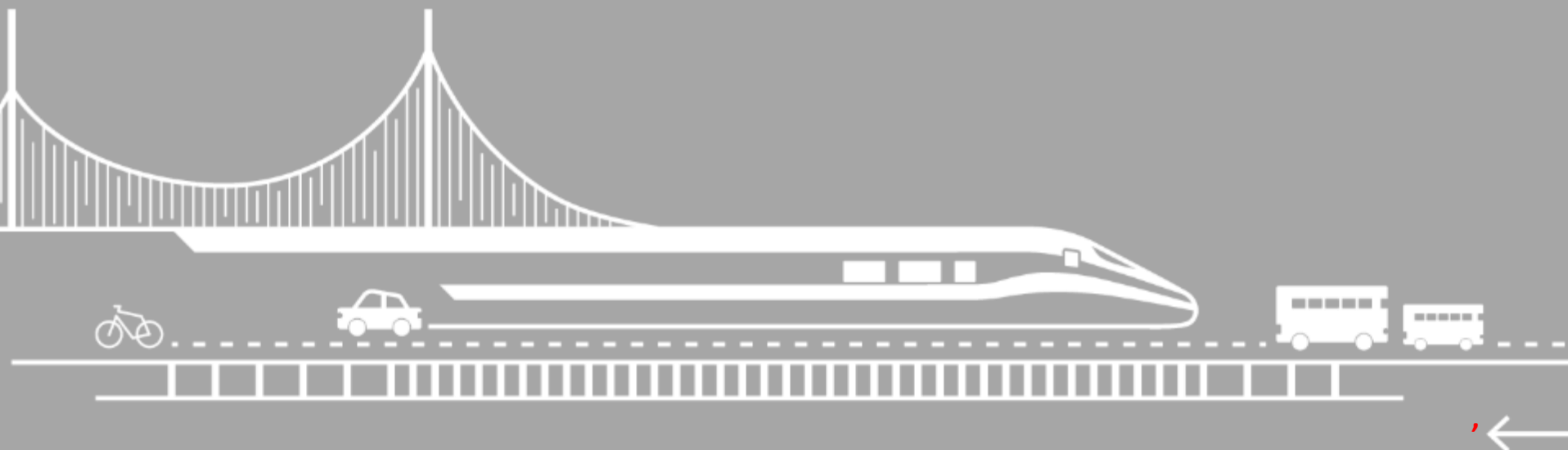
SOLUTIONS FOR LOW NOISE ROAD SURFACES

Italian national roads adopt low noise road surfaces

Patrizia Bellucci

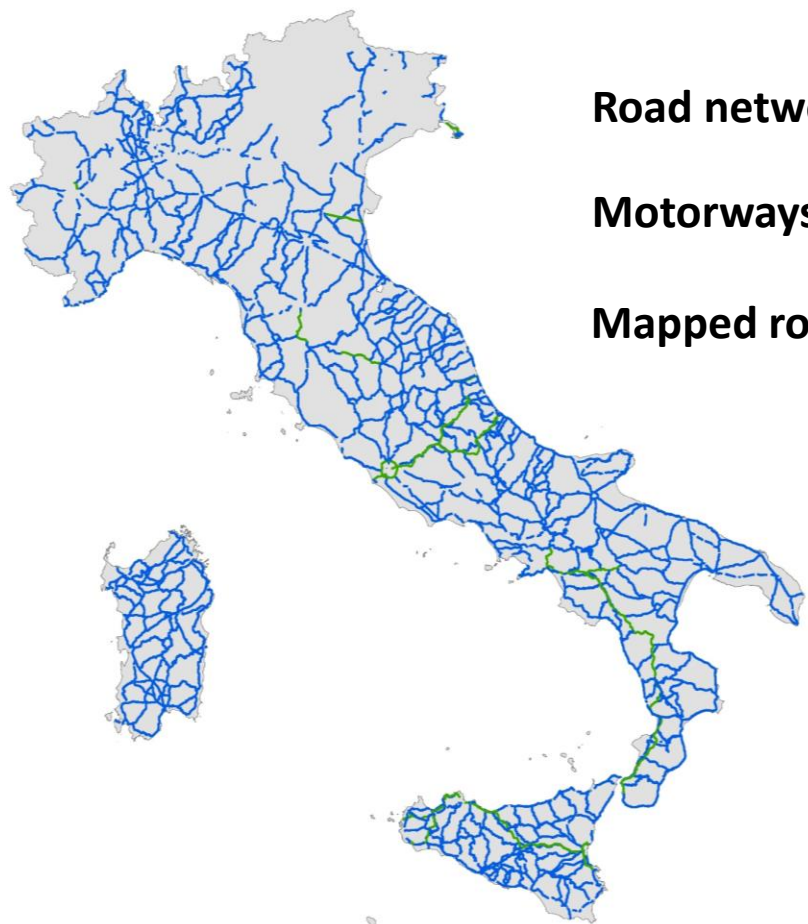
ANAS S.p.A. – Research and Development

06 February 2024



THE CONTEXT

Noise Mapping and Action Plan



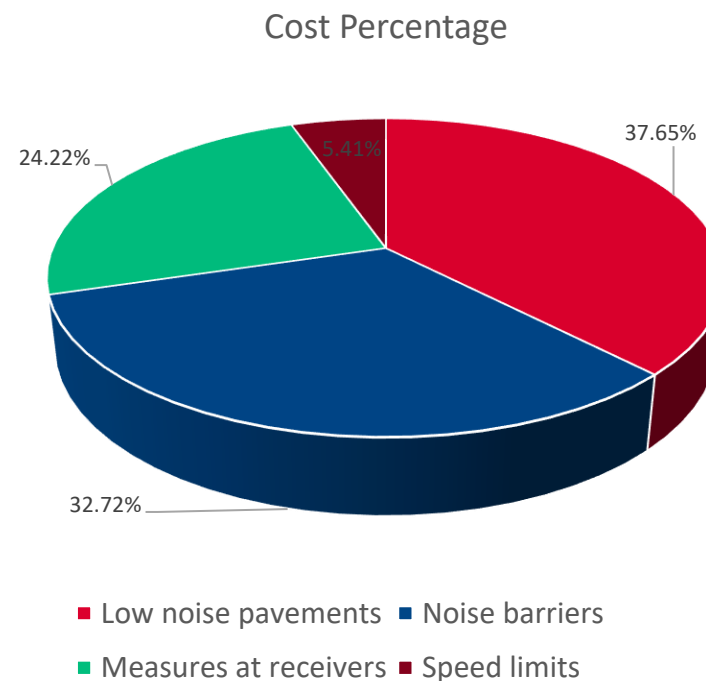
Road network: 32.256 km

Motorways: 939 km

Mapped roads: 9.564 km

ACTION PLAN

Noise mitigation Measures



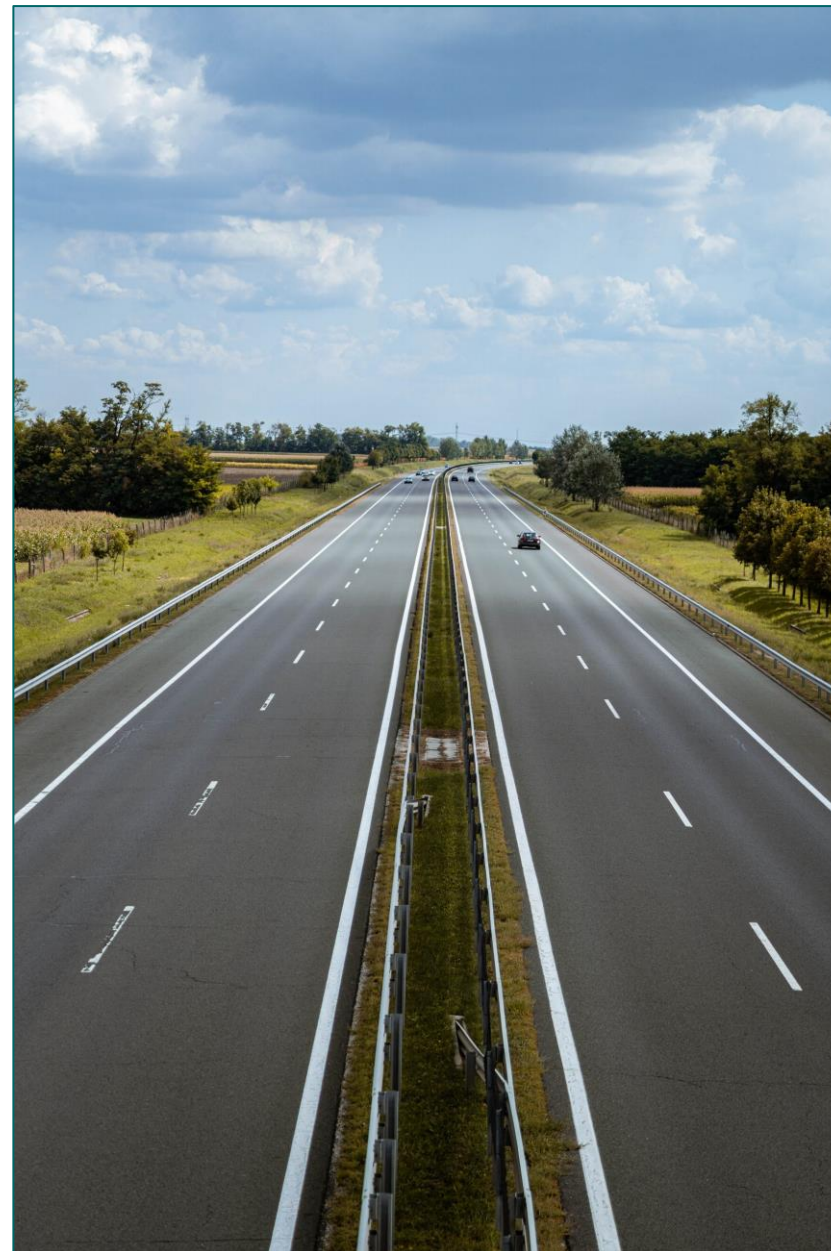
The Action Plan provides for the implementation of low noise pavements on almost all of the identified critical areas (2,338 km), in conjunction with other sound mitigation measures..

THE CONTEXT

Minimum Environmental Criteria

Minimum Environmental Criteria apply for closed-type wearing courses (as defined by the standard UNI EN 13108) exclusively on roads of the primary network, as well as on roads of other categories where noise mitigation measures must be implemented.

Speed (km/h)	L _{CPX} (dB(A))
40	88,0
50	91,0
60	93,5
70	96,0
80	97,5
90	99,0
110	101,5
130	103,5

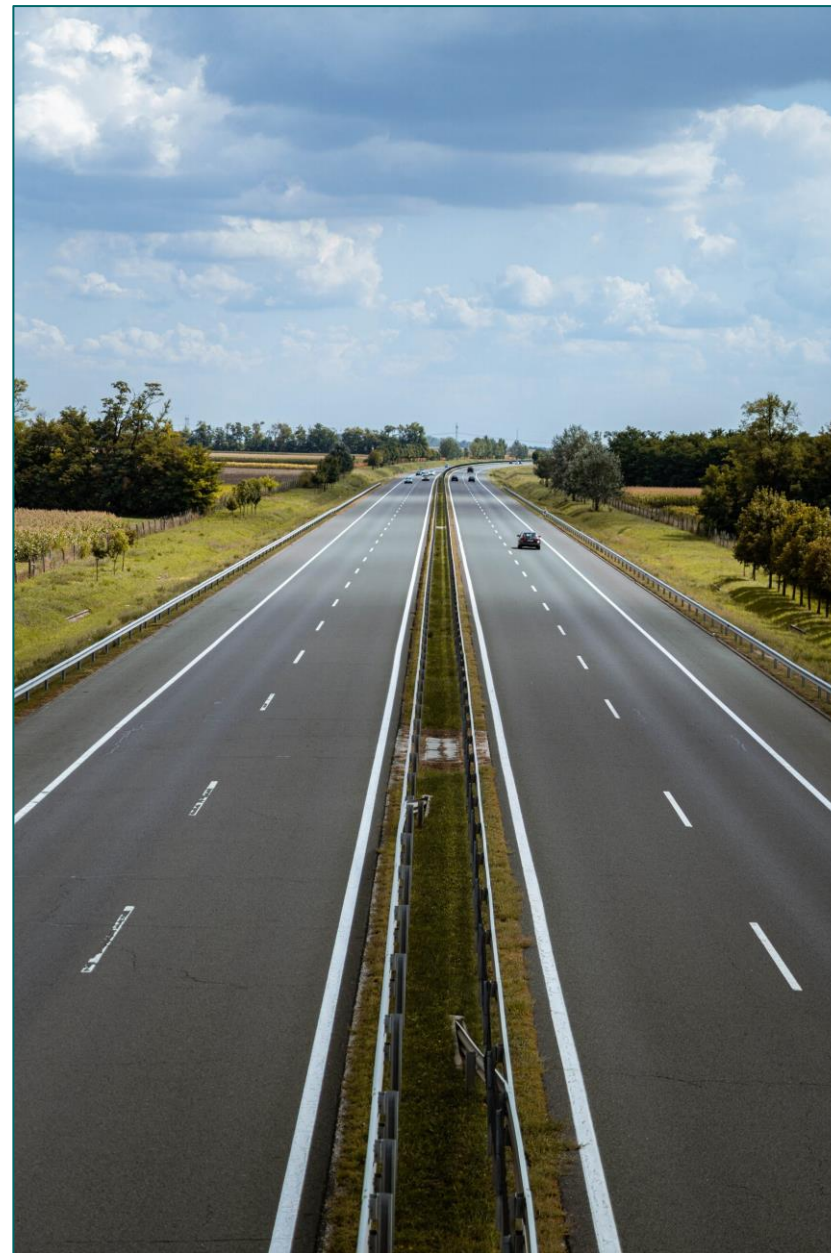


THE CONTEXT

Minimum Environmental Criteria

The document promotes the use of sustainable and recycled materials, including ELTs (End-of-Life Tyres), in road infrastructures through a series of environmental criteria and sustainable construction techniques.

- ❑ **Minimum or recommended performance as a rewarding criterion** for the assignment of design services and execution of construction, maintenance, and upgrading works of road infrastructures.
- ❑ **Use of Recycled, Recovered, or By-Product Materials:** encourages the use of recycled, recovered, or by-product materials for the construction of infrastructural works.
- ❑ **Project Technical Specifications Related to the Construction Site:** Includes guidelines on how to integrate sustainability and the use of recycled materials into the project technical specifications of construction sites .
- ❑ **Pavement Service Life:** Evaluate the service life of the pavement as part of the criteria to ensure long-term sustainability and efficiency.



WHAT KIND OF LOW NOISE PAVEMENT?

Tested technologies

Test site SS73 «Senese-Aretina» - Year 2019



Four types of wearing course:

- 1 «**Type B**» reference wearing course as per ANAS specifications.
- 2 An experimental wearing course, with «**optimized texture**».
- 3 A wearing course with crumb rubber, achieved with a «**wet process**».
- 4 A wearing course containing crumb rubber, achieved with a «**dry process**».



“**Optimized texture**” road surface engineered to provide enhanced performance characteristics. This type of pavement typically features a carefully designed aggregate gradation that results in a tight, interlocking structure, which can offer improved durability and reduced noise levels.

“**Wet**”**Technology** (asphalt rubber o hybrid-wet) Crumb rubber is mixed into bitumen to obtain an elastomerized bituminous mastic.



“**Dry**” **Technology** Crumb rubber is combined with aggregates along with filler, bitumen, and other possible additives.

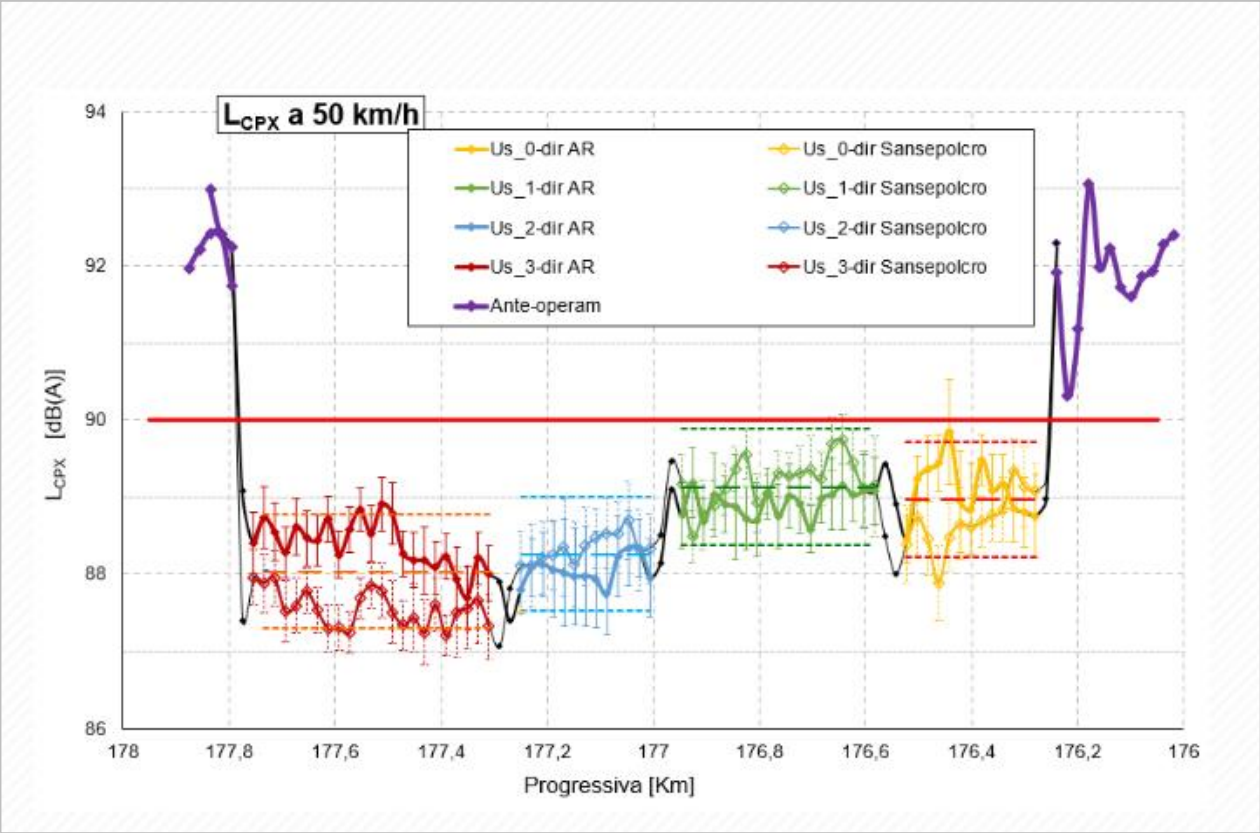


WHAT KIND OF LOW NOISE PAVEMENT?

Test results

Test site SS73 «Senese-Aretina» - Year 2019

Acoustic performance



TIPOLOGIA DI MISCELA	L _{CPX} PER CORSIA		σL _{CPX}	L _{CPX}	LIMITE GPP
	[dB(A)]		[dB(A)]	[dB(A)]	[dB(A)]
Us_0	Dir. Arezzo	89,2 ± 1,0	0,4	89,0 ± 0,7	90
	Dir. Sansepolcro	88,8 ± 1,0	0,4		
Us_1	Dir. Arezzo	89,0 ± 1,0	0,2	89,1 ± 0,8	90
	Dir. Sansepolcro	89,3 ± 1,0	0,3		
Us_2	Dir. Arezzo	88,1 ± 1,0	0,2	88,2 ± 0,7	90
	Dir. Sansepolcro	88,4 ± 1,0	0,2		
Us_3	Dir. Arezzo	88,5 ± 1,0	0,3	88,0 ± 0,7	90
	Dir. Sansepolcro	87,6 ± 1,0	0,2		

PERFORMANCE INDICATORS

Strenghts

- ↑ **Service life:** depends on various factors, including environmental conditions, traffic volumes and type.
- ↓ **CO2 Emissions:** -30% if the lifecycle exceeds the expected 3-4 years of conventional pavement duration.
- ↓ **Waste eliminated from landfill:** 1 tire for every 7 m² for 4 cm of pavement thickness. A road 1 km long and approximately 7 m wide allows for the recycling of 1000 tires (about 7-10 tons).
- ↑ **Costs:** Higher initial investment, offset by the longer lifespan of the pavement and the reduced maintenance required.

Mix type/Technology	% Rubber or Compound	Bitumen type	Bitumen (%)	Cost Index	Durability	Noise Reduction
Reference wearing course (ANAS)	-	50/70	57%	100	*	*
SMA	-	PmB	65%	122	***	**
SMA Hybrid Wet	5%	PmB hybrid	67%	121	***	**
Asphalt Rubber	13%	Asphalt Rubber WMA	7%	123	***	***
Hybrid Dry	10%	PmB-WMA	65%	124	*****	*****
Dry - New generation	5%	t.q.	62%	113	***	***

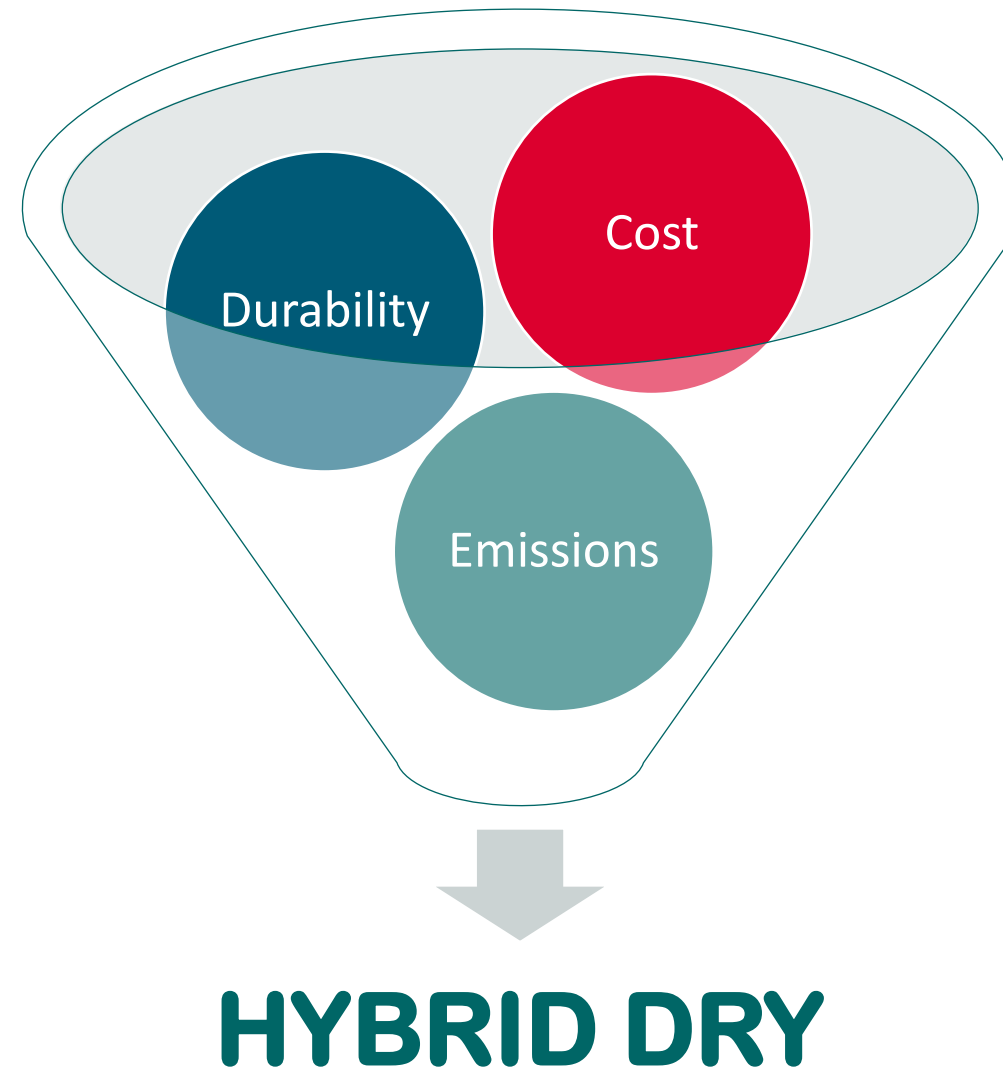
PERFORMANCE INDICATORS

Cost/Benefit analysis

DURABILITY is a key factor in maximizing the benefit/cost ratio because more durable pavements require less maintenance and have a longer lifespan.

The initial **COST** is another important factor. A lower cost index may indicate an initial saving, but it is necessary to balance this saving with the durability and long-term performance of the pavement.

The **ACOUSTIC PROPERTIES** are a significant benefit, especially in urban or residential areas, as well as the reduction of **CO2** in the environment and the **RECYCLING** of ELTs (End-of-Life Tyres)."



PERFORMANCE INDICATORS

Critical aspects

Polycyclic Aromatic Hydrocarbons (PAHs) released when laying rubberized pavement show higher concentrations compared to conventional pavements.

Variability of PAC Concentrations: The concentrations of airborne PAC vary significantly among different types of paving operations.

Presence of Carcinogenic PACs: the importance of safety measures and protection for workers.

Need for Further Studies: The amount of data is limited and thus insufficient to perform complete statistical analyses. This indicates the need for further studies and surveys to have a clearer and more comprehensive picture of the environmental impact and health during the paving of roads.

Absence of Threshold Values: threshold limits for these substances have not been defined.

Volatile Organic Compounds (VOCs): Measurements of formaldehyde (a carcinogenic substance) and acetaldehyde (potentially carcinogenic) have shown exposure values higher than background levels.

PACs

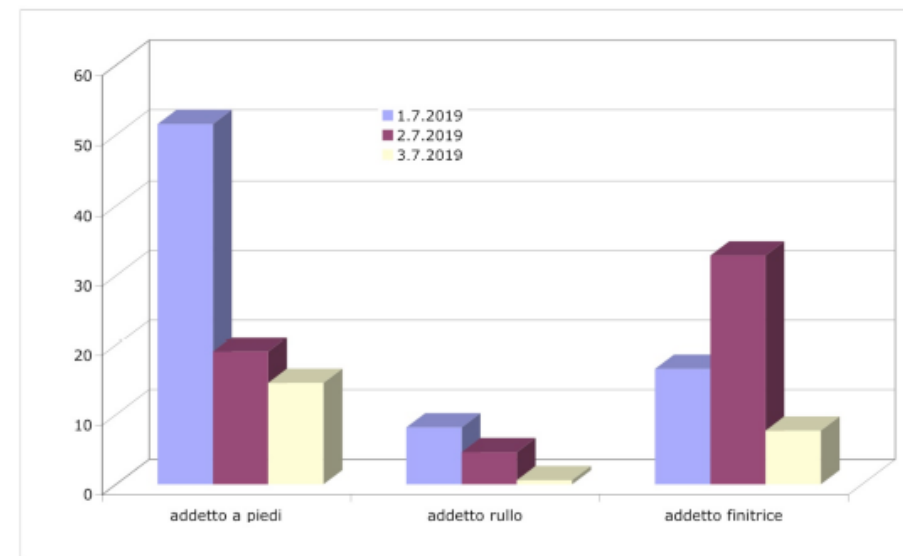


Figura 1: dosi respiratorie (microgrammi) determinate per gli IPA totali negli addetti alla pavimentazione stradale

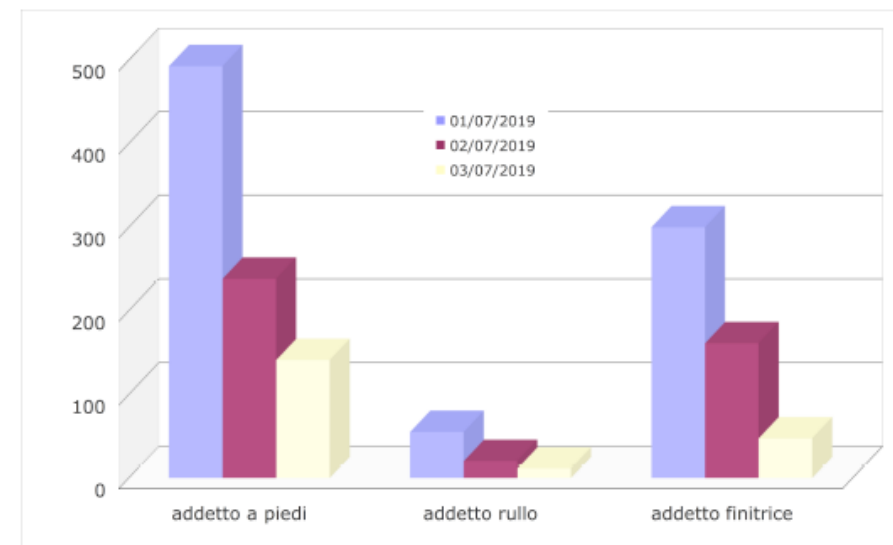


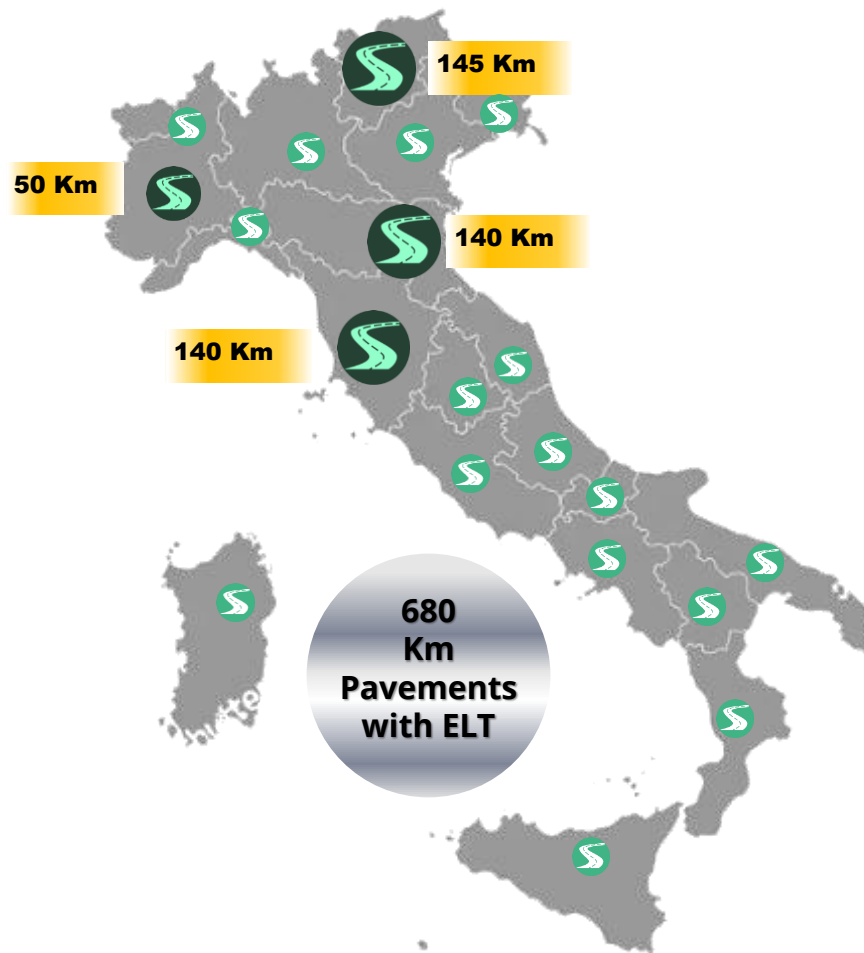
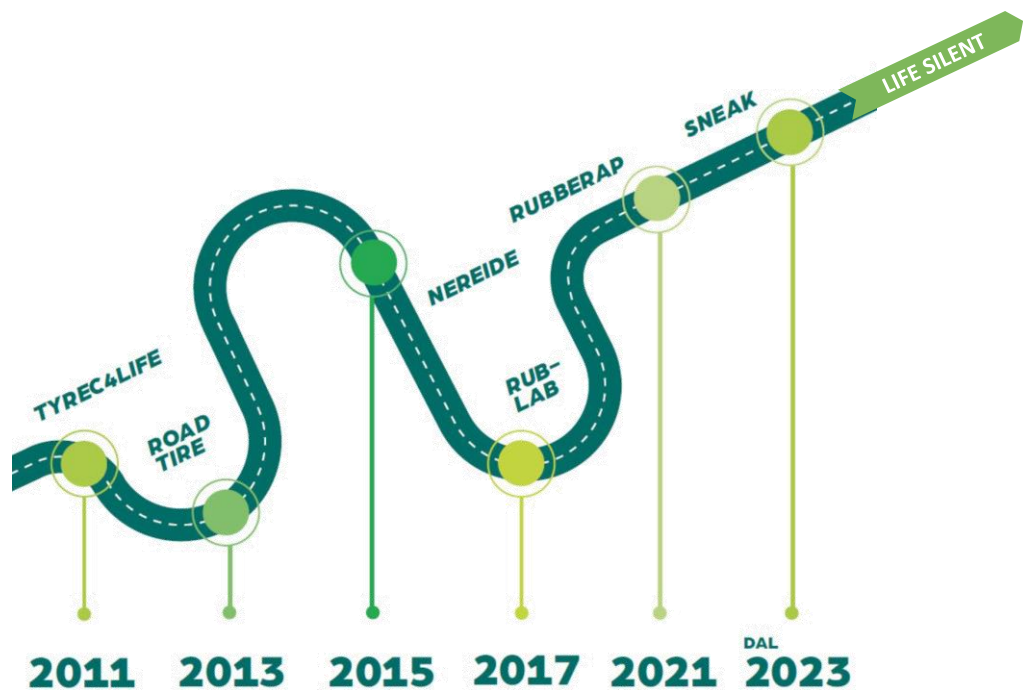
Figura 2: dosi cutanee (microgrammi) determinate per gli IPA totali negli addetti alla pavimentazione stradale

Dry
 Wet
 ANAS

PROMOTING RUBBERIZED PAVEMENTS IN ITALY

Experimental test sites and studies

Since 2011, several research projects have been undertaken focusing on the use of bitumen modified with crumb rubber from End-of-Life Tires, the latest being the European **LIFE SILENT** project which started in September 2023, proposed and coordinated by ANAS.



Over 680 km of roads have been implemented in Italy using asphalt modified with recycled rubber from End-of-Life Tires: but the approach is still too often experimental or outside of a medium to long-term organized project.

THE LIFE SILENT PROJECT

Overview



The main objective of the **LIFE SILENT PROJECT** is the development and implementation in a real test site of sustainable and eco-friendly solutions to mitigate noise in complex urban environments, where road and railway noise sources coexist.


CHALLENGES

- To manage noise mitigation measures in a coordinated and synergistic way.
- To support the implementation of noise mitigation measures at the source.

THE LIFE SILENT PROJECT


Objectives

1




Increase the service life of low noise pavements to reduce their cost.

2



Improve the acoustic, structural, and safety performance of low height noise barriers through the design and validation of an innovative product.

3



Define procedures to manage and implement noise mitigation measures in complex environmental scenarios.

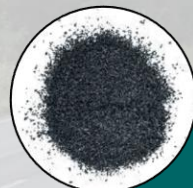


LOW NOISE PAVEMENTS

+20% of service life
-14% cost



Modified Bitumen



Crumb Rubber



Cellulose Fibres



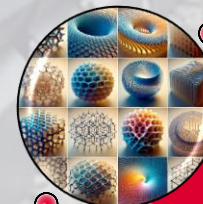
Cardboard



LOW HEIGHT NOISE BARRIERS



Crumb Rubber



Metamaterial



STRAIL's Low Height
Noise Barrier

THE LIFE SILENT PROJECT

Methodological approach

The third objective will be pursued by developing and testing an operational methodology to support the coordination and implementation of noise mitigation measures of various nature and type to ensure the integration of the envisaged solutions and optimal results, both in terms of effectiveness and efficiency.



CONCLUSIONS



ANAS's **ACTION PLAN** necessitates widespread solutions for noise reduction, not limited to areas barely exceeding noise limits but also where low-noise pavements can reduce the need for larger, expensive measures like noise barriers.



The **Italian CAM** draft decree reflects this by mandating low-noise pavements, even on roads that don't need the implementation of noise mitigation measures.



Measurement campaigns by ANAS to assess low-noise pavements, especially those with recycled tires, have been implemented with unsatisfactory results → ANAS is persisting in testing for solutions that achieve long-term effectiveness.



The LIFE SILENT project aims to create **durable solutions and operational procedures** to enhance noise mitigation in complex environments.



The overarching solution is a **holistic approach**, integrating various noise mitigation measures for optimal synergy and effectiveness.

THANK YOU

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