LIFE E-VIA

Electric **V**ehicle no**I**se control by **A**ssessment and optimisation of tyre/ road interaction

www.life-evia.eu

LIFE E-VIA PROJECT – III Monitoring visit 25th February 2022

Overview of project's implementation

Comune di Firenze

Arnaldo Melloni – project manager

Gessica Pecchioni, Iacopo Bianchi

With the contribution of the LIFE programme of the European Union

LIFE18 ENV/IT/000201

AGENDA

- 9:00 - 9:15 Participants registration
- 9:15 - 9:30 Welcome from the city of Florence Ass. Cecilia Del Re
- 9:30 - 9:45 Partners' presentation
- 9:45 - 11:45 Technical session part one: Presentation of the project activities action by action. Each partner presents a presentation summarizing and updating each action. Illustration of expected documents and achieved milestones. Possible illustrations of the possible issues, delays, authorizations (20 min per partners)
- 12:00 - 13:30 Technical session part two: Discussion and update of the impact indicators; Policy implications: overview of the possibilities for updating and improving environmental policies (local, national, and European) related to the project; Overview of the replication potential and actual strategies/specific plans during and after the project; Focus presentation on the asphalt characteristics; Focus presentation on the tire prototypes; Discussion on the marketability of the developed technologies (tires, asphalts); Discussion on the impact of the Covid-19 emergency on the project
- 13:30 - 14:30 Break
- 14:30 - 15:30 Pilot road visit
- 16:00 - 18:00 Financial and administrative session; Collection of the supporting documents

ACTION E1

PROJECT MANAGEMENT

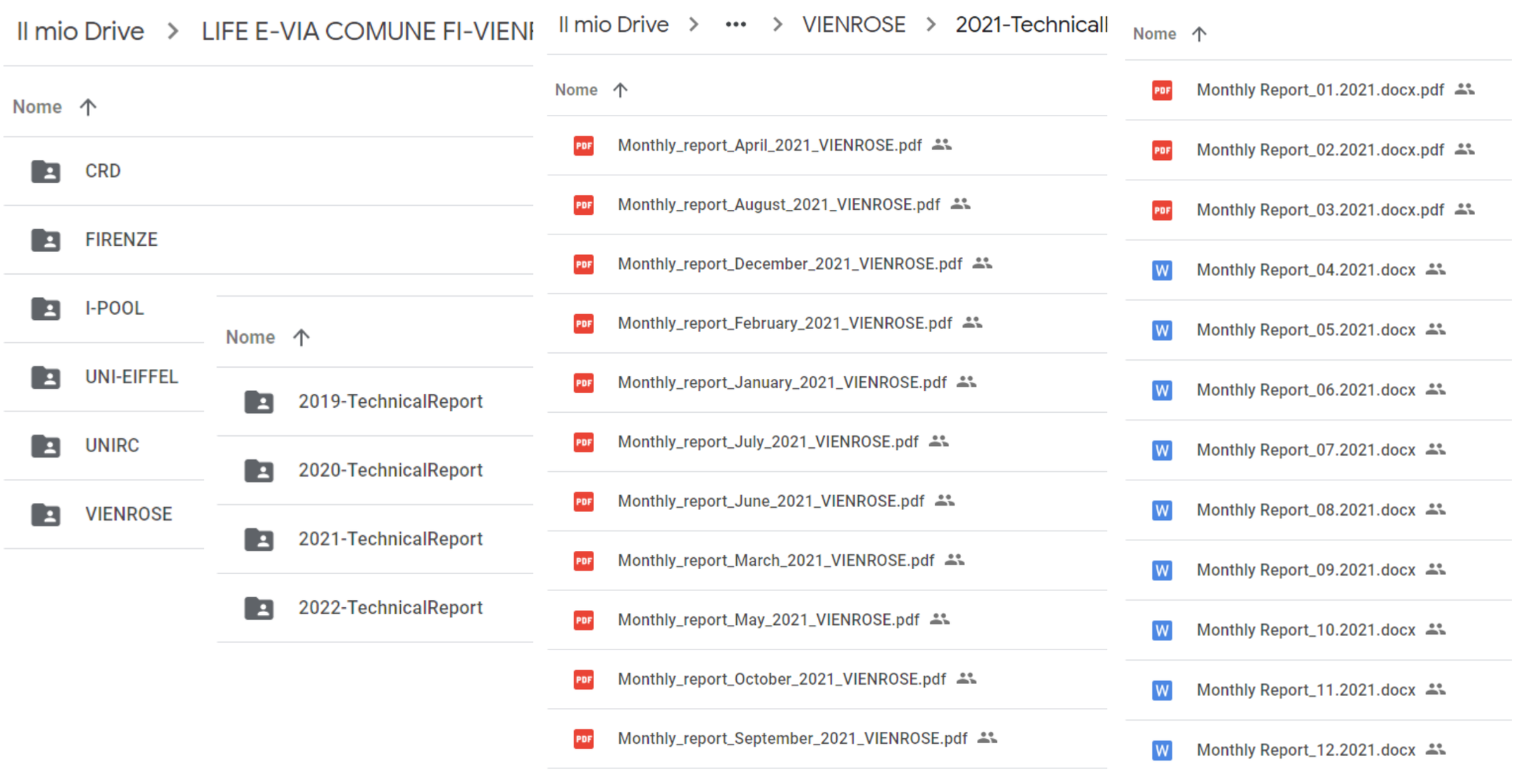
PROJECT GANTT

Action		2019				2020				2021				2022				2023			
Action number	Name of the action	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
A. Preparatory actions																					
A.1	Electric vehicles and their noise emission			■	■	■															
A.2	Quiet pavement technologies and their performance over time			■	■	■															
A.3	Tyre role in the new context of EV and ICEV			■	■	■															
B. Implementation actions																					
B.1	Tracks design				■	■	■	■	■	■											
B.2	Tyre-pavement coupling study and prototype implementation			■	■	■	■	■	■	■	■	■									
B.3	Pilot area: Implementation						■	■	■	■	■	■	■	■	■	■	■	■			
B.4	Track efficiency tests in the pilot area							■	■	■	■	■	■	■	■	■					
B.5	Soundscape analysis			■	■	■	■	■	■	■	■	■	■	■							
B.6	Evaluation of EV noise emissions							■	■	■	■	■	■	■	■	■					
B.7	Holistic performances of tyres			■	■	■	■	■	■	■	■	■	■	■	■	■	■				
B.8	Replicability and Transferability							■	■	■	■	■	■	■	■	■	■				
C. Monitoring of the impact of the project actions																					
C.1	Monitoring of the impact of the project actions			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
C.2	Life cycle analysis (LCA) and life cycle costing (LCC)			■	■	■	■	■	■	■	■	■	■	■	■	■	■				
D. Public awareness and dissemination of results																					
D.1	Information and awareness raising activities			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
D.2	Technical dissemination activities to stakeholders			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
E. Project management																					
E.1	Coordination, Monitoring and Project management			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
E.2	After LIFE Plan																■	■			

5 actions concluded (A1, A2, A3, B1 and B2), all other actions in progress.

OVERVIEW OF PROJECT IMPLEMENTATION

- Overall, technical actions are proceeding regularly and monitored by means of a technical monthly report, provided by each partner.



EXPECTED DELIVERABLES period 2019-mid 2022

Name of the deliverable	Number of the associated action	Deadline	State of implementation
Dissemination plan	D1	30/09/2019	✓
Monitoring protocol	E1	30/09/2019	✓
Life E-VIA Website	D1	31/12/2019	✓
Technical Report Actions A1,A2,A3	A1	31/03/2020	✓
Technical Report Actions A1,A2,A3	A2	31/03/2020	✓
Technical Report Actions A1,A2,A3	A3	31/03/2020	✓
B3 Tender specification definition	B3	28/02/2021	✓
B1 Report	B1	31/03/2021	✓
B2 Report on prototype implementation and tyre/road noise performances	B2	30/11/2021	2.5 months of delay expected
Video of the prototype construction	D1	31/12/2021	✓
B3 Report about the implementation in the pilot area	B3	31/03/2022	In progress
B5 Report	B5	30/04/2022	In progress
3 press conferences	D1	31/07/2022	1/3 done

EXPECTED MILESTONES period 2019-2021

Name of the milestone	Number of the associated action	Deadline	State of implementation
Project kick off/nomination of Committees	E1	31/10/2019	✓
Life E-VIA Website launching	D1	31/12/2019	✓
B1 Tracks design	B1	31/01/2021	✓
B3 Tender's assignment	B3	31/05/2021	✓
B2 Tyre-pavement coupling study - Prototype realization	B2	30/09/2021	✓
B3 Construction of low-noise tracks in the pilot area	B3	30/09/2021	✓
B5 Soundscape analysis reporting	B5	30/04/2022	

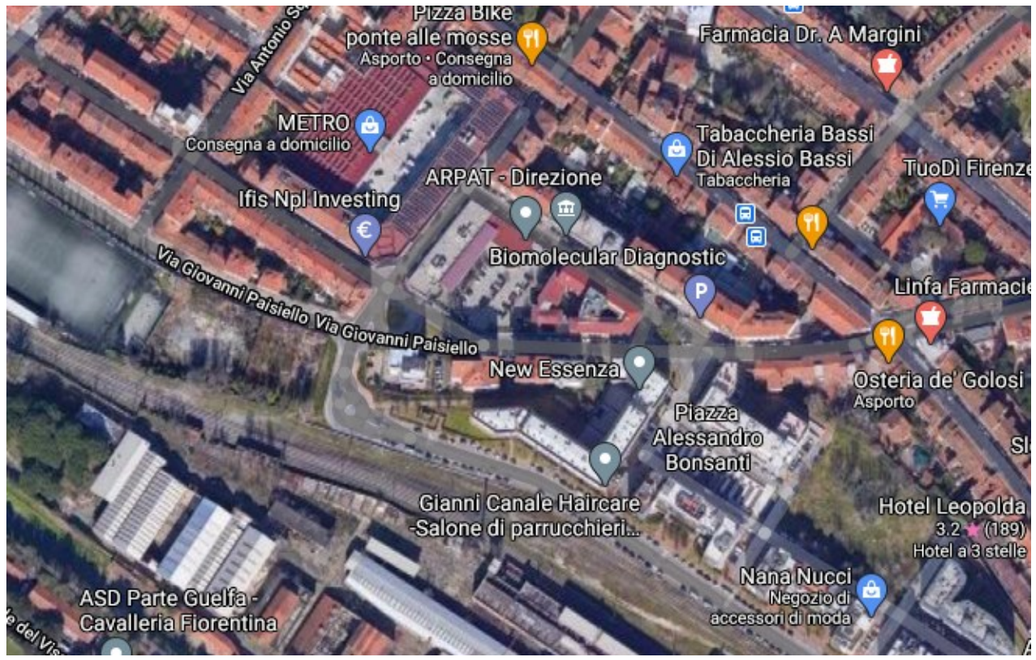
INTERNAL MEETINGS

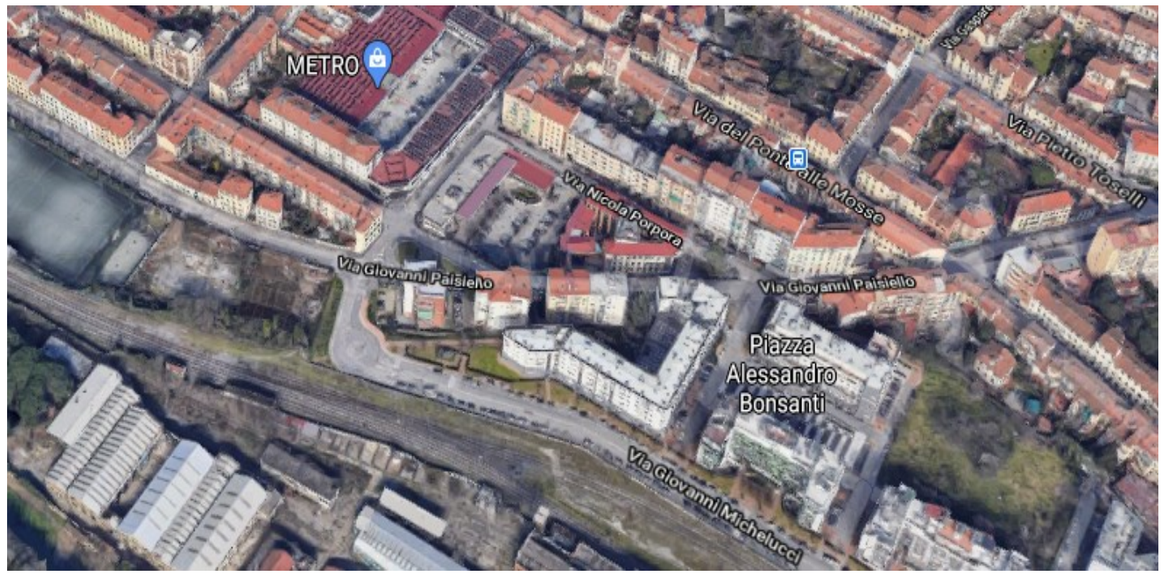
Aim of the meeting	Date	Place	Partners involved
Project preparatory meeting	9 January 2019	Florence	ALL
Kick off preparatory meeting	6 September 2019	Online	FIRENZE, VIENROSE, UNIRC, I-POOL
Kick off meeting	20 September 2019	Florence	ALL
Official kick off meeting	7-8 November 2019	Bruxelles	FIRENZE
I monitoring visit preparatory meeting	20 February 2020	Florence	ALL
Steering committee meeting for progress report drafting	12 June 2020	Online	ALL
Progress of the project activities	28 July 2020	Online	ALL
Mid Term Report preparation	23 October 2020	Online	ALL
Progress of activities related to pilot case implementation	5 March 2021	Online	FIRENZE, VIENROSE, UNIRC, I-POOL
II monitoring visit preparatory meeting	14 April 2021	Online	ALL
Progress of the project activities	11 October 2021	Reggio Calabria + online	ALL

ACTION B3

PILOT AREA IMPLEMENTATION

Pilot case: Paisiello street





Paisiello street: characteristics of the road

1)Two-way travel without significative curves

2)Significant population density of the area

3)Busy road due to traffic toward the city center

4)Close to public offices (Regional Agency for Environment Protection and Metropolitan)

5) Close to the most relevant park in Florence (Cascine)

6) Close to one of the most important intervention of urban requalification (ex Manifattura Tabacchi) with new dwellings, primary school, fashion school (university)

Construction related procedures

- Technical documents: September 2020
- New mixture definition (technical minimum requirements actions B1 e B2). Included as specification in the tender documents - December 2020
- Tender and award notice published: March 2021
- Winner legal documents received: June 2021
- Implementation: mid July 2021

Report on Action B3

- In progress

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Work in progress….

Post operam

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TECHNICAL SESSION PART 2

H. 12,00-12,30

LIFE E-VIA project indicators updating

Objective	Indicators	Estimated Impact (absolute values)	Estimated Impact (in %)	Current value	Notes
Communication, dissemination, awareness rising	Number of entities/individuals reached/ made aware	20000	40%	149521	Considering 80 visitors to the LIFE E-VIA stand at Expomove, 100 students involved in awareness lessons addressing also the project, 200 residents of via Paisiello who received informative letters about the project and the survey initiative, and the 1% of followers of 31 webpages/websites which published news about the project
	Number of website's visits	70000		6699	According to the trimestral report about C1 action
Soundscape improvement	Improvement of acoustic perception and comfort of an optimized asphalt with respect to a standard one	-	50%	50%	According to the questionaires results
Noise levels reduction	Reduction of Lnight noise levels	-4.4 dBA	-	-4.4 dB(A)	
	Reduction of LCPX in Firenze	90 dBA	-	87.5 dBA ± 1.5	

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LIFE E-VIA KPI updating

Indicator code	First level descriptor	Start value	End value	Beyond End value	Unit	Notes
1.5	Conservation or improvement of the status of an area or segment	0	2,5	7,5	km2	The area lenght has been calucalted considering a buffer of 50 m per side of the road where Pilot intervention will be realized. "Beyond 3 years" data are referred to the other 2 replicated areas that will be realized and which are already planned After the three replication interventions, the value «beyond end» could be increased
1.6	Persons whose lives were directly, positively impacted by MAIN envir. actions of project	0	2000	6000	Number of residents within or near the project area	After the three replication interventions, the value «beyond end» could be increased
10.2	Other	0	10	15	Number of stakeholders involved due to the project	Number reached according to webinars/events/presentations held also in digital mode The final calculation will be done at the end, but the value «beyond end» will surely be higher than 15
11.1	No. of unique visits	0	70000	170000	Number	Current value: 6699
11.2	Number of articles in print media (e.g. newspaper and magazine articles)	0	400	400	number	Current value: 31
11.2	Number of different displayed information created (posters, information boards)	0	30	30	number	16 on 30 noticeboards produced, 1 roll up
11.2	Other distinct media products created (e.g. different videos/broadcast/leaflets)	0	3	3	number	4 on 3: 2 videos+1 leaflet+1 press conference
11.2	Number of events/exhibitions organised	0	4	4	number	2 on 4: Webinar on the LIFE E-VIA projects and other contributions + stand at Expomove 2021
11.2	Publications/reports	0	40	40	number	27 on 40: 9 report and 18 papers delivered; Foreseen: 4 international conferences, 2 national conferences
11.2	Number of Hotline/information centers created	0	1	1	number	Current value: 1 (website contact form)

POLICY IMPLICATIONS

Policy implications:

2nd March 2021: Noise Working Group of Eurocities network.

One of the agenda points was "what's guiding the Commission's work on noise?"
European Commission is establishing *"to develop coherent rules for environmental, energy and safety performance of tyres in 2023. From the strategy: "The evolution of road vehicle engines towards zero emission does not as such solve issues raised by the use of tyres, which still cause noise and microplastics. The latter pollute our waters and seas and can ultimately enter the food chain. High-performing tyres should be further promoted as they reduce energy consumption and emissions (including of rolling noise) while maintaining vehicle safety."*

Preliminary results on roads shows that quiet roads not so effective but quiet tyres are (would need to implement quiet roads all over agglomeration so less cost effective).

17th March 2021: Meeting with Mr. Marco Paviotti (officer at the European Commission DG Environment where he follows the EU policy on environmental noise and urban environment)

Mr. Marco Paviotti asked Florence Municipality (as LIFE E-VIA coordinating beneficiary) to hold a meeting to be updated on LIFE E-VIA project, which is considered very relevant regarding the above-mentioned issues. The meeting was held and several preliminary results about our project shared.

POLICY IMPLICATIONS

- Contribution for updating CNOSSOS model parameters for EV vehicles (Action B.6)

- Technical specifications of the LIFE E-VIA asphalt could become a new standard. Florence Municipality is already adopting it according to the maintenance plan, in case criticalities are envisaged in the Strategic Noise Mapping of the agglomeration

ACTION B8

REPLICABILITY AND TRANSFERABILITY

According to the satisfactory results of the post operam test and measures, **three more areas in Florence** have been identified for the replication:

- Laying of the Life E-VIA asphalt along the entire Paisiello Street. **Citizens asked municipality to extend the repaving, since they directly perceived acoustic benefits**.

- Via Bolognese

- Via Senese

A total amount of € 500,000 have been budgeted for these interventions

In the project proposal, it was foreseen to replicate in 3 more sites, in the 5 years after the project end.

- **Instead, thanks to requests from citizens and very encouraging results, replication will take place between the end of 2022 and the beginning of 2023, i.e. while the project is still underway.**

DISCUSSION ON THE IMPACT OF COVID-19 ON THE PROJECT

- Due to the continuing pandemic, tests to be carried out by I-POOL in Nantes have been delayed to June 2021 but this didn't have a direct influence on related activities.

- Despite the spread of Covid-19 pandemic, dissemination activities have been nevertheless carried out, making efforts to concentrate on "digital" activities such as networking with other projects/associations/public entities etc., publishing of short articles on local and national newspapers, organization of an online webinar.

- The major impact has been on the financial aspect related to **Travel costs** which are significatively less than those foreseen in the budget, although dissemination activities have been regularly carried out. Question: is it possible to reallocate savings from travel cost category to a different cost category?

LIFE E-VIA

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LIFE18 ENV/IT/000201

LIFE E-VIA Monitor Visit
Florence – 25th February 2022

LIFE18 ENV/IT/000201

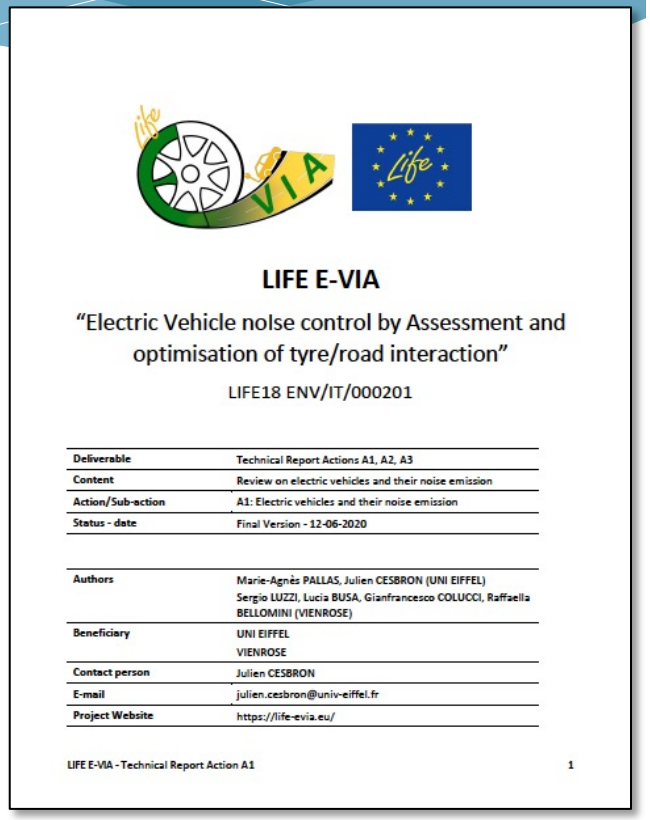
Technical progress of actions: A1 - Electric vehicles and their noise emission B2 - Tyre-pavement coupling study

Marie-Agnès PALLAS, Julien CESBRON

Université Gustave Eiffel (UNI EIFFEL)
Joint Research Unit in Environmental Acoustics (UMRAE)

Action A1 - EVs and their noise emission

- Preparatory action (Months 3 to 9)
- Literature review considering different aspects:
  - EV fleet and distribution across Europe
    (linked with action B2 and B3)
  - Changes in driving style of EV and impact on noise
    (linked with actions B1 and B2)
  - Noise source emission of EVs
    (linked with action B2)
  - Noise perception of EVs
    (linked with action B5)
  - EV consideration in noise prediction models
    (linked with action B6)
- Contributing partners: UNI EIFFEL, VIENROSE, UNIRC
- Deliverable validated on 12/06/2020



LIFE E-VIA

"Electric Vehicle noise control by Assessment and optimisation of tyre/road interaction"

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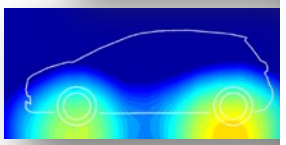
Deliverable	Technical Report Actions A1, A2, A3
Content	Review on electric vehicles and their noise emission
Action/Sub-action	A1: Electric vehicles and their noise emission
Status - date	Final Version - 12-06-2020

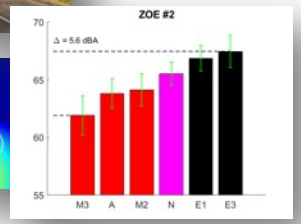
Authors	Marie-Agnès PALLAS, Julien CESBRON (UNI EIFFEL) Sergio LUZZI, Lucia BUSA, Gianfrancesco COLUCCI, Raffaella BELLOMINI (VIENROSE)
Beneficiary	UNI EIFFEL VIENROSE
Contact person	Julien CESBRON
E-mail	julien.cesbron@univ-eiffel.fr
Project Website	https://life-evia.eu/

LIFE E-VIA - Technical Report Action A1 1

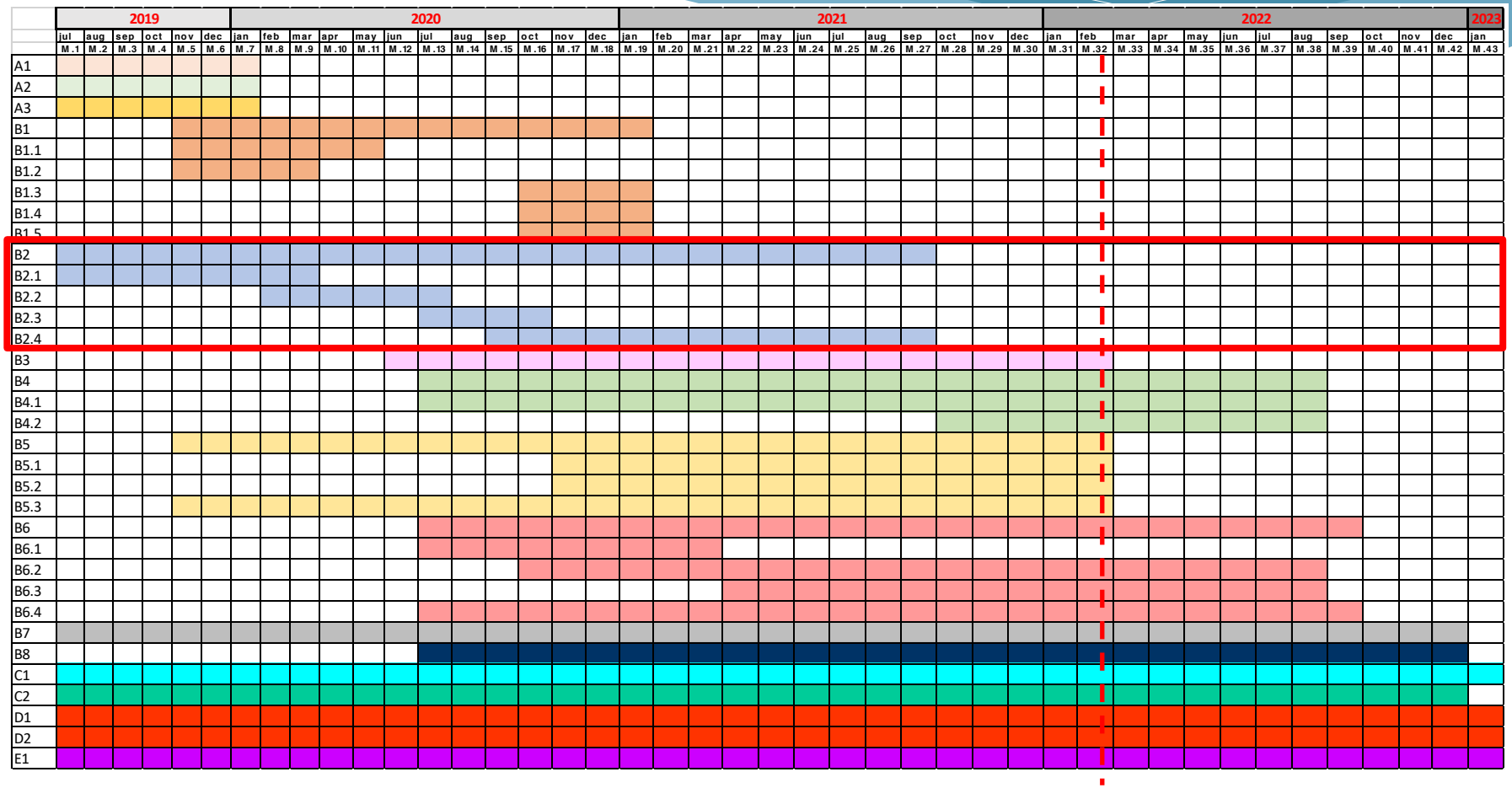
Action B2 – Tyre-pavement coupling study

- Implementation action divided in 4 sub-actions:
  - B21: Acoustical characterization of EVs on existing tracks (UNI EIFFEL)
    - Months 1 to 9 – done
  - B22: Construction of a B1-based test track prototype (UNI EIFFEL, UNIRC)
    - Months 8 to 13 – done
  - **B23: Characterization of the B1-based prototypal test section** (UNI EIFFEL, IPOOL)
    - Months 13 to 16 – done
  - **B24: Selection of optimized EV tyres** (CRD, UNI EIFFEL)
    - Months 15 to 27 – on-going





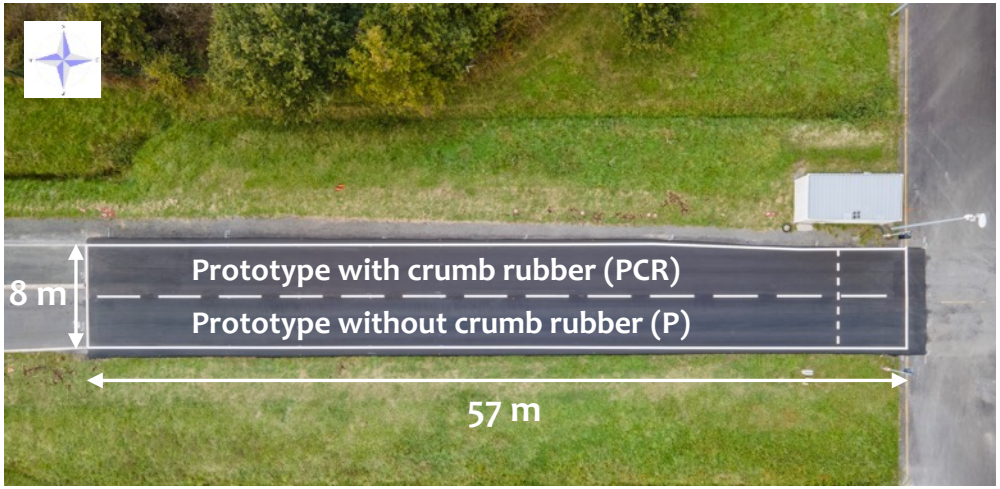
Action B2 – Tyre-pavement coupling study



- Milestone: B2 Tyre-pavement coupling study – Prototype realization – 30/09/2021
- Deliverable: B2 Report on prototype implementation and tyre/road noise performances – 30/11/2021 (delayed to 04/03/2022)

Action B22 – Prototype construction

- Final prototype

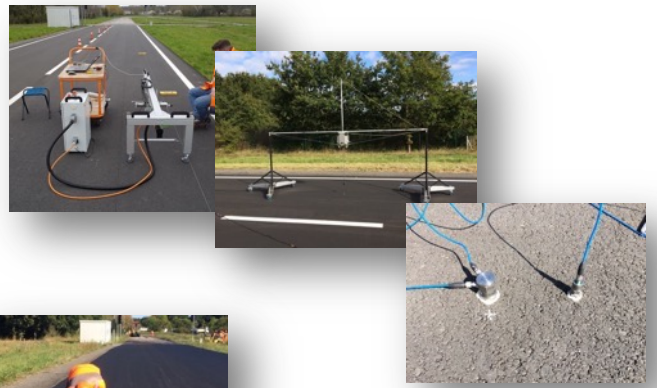


PCR

P

Action B23 – Prototype characterization

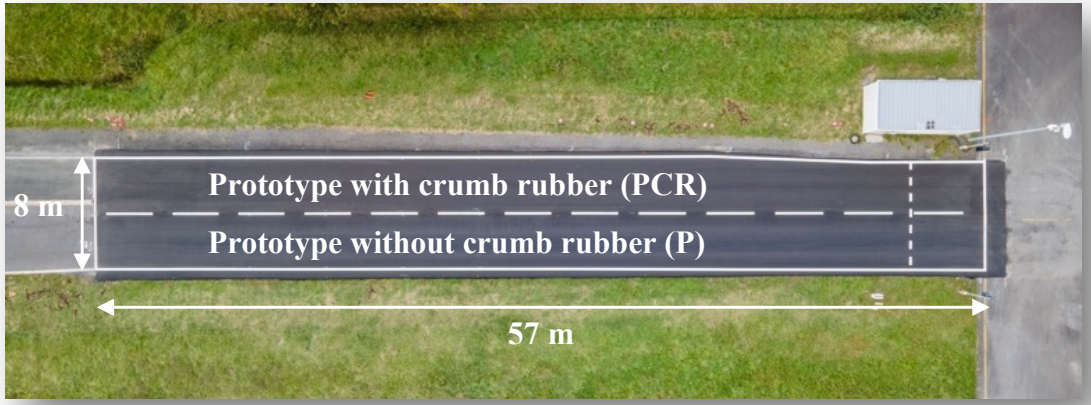
- Measurement campaign in Sep/Nov 2020 and spring 2021
- CPB and microphone array measurements for a selection of EVs (10/2020)
- Measurement of road surface properties influencing tyre/road noise
  - 3D surface texture (03/2021)
  - Sound absorption - extended surface method (09/2020)
  - Mechanical impedance (03/2021)
- Other road surface properties
  - SRT pendula friction tests (09/2020)
  - MPD measurements (09/2020)
  - Dynamical wet friction test (03/2021)
  - Wehner and Schulze tests (03/2021)



- **CPX measurements (UNI EIFFEL 04/2021 and IPOOL 06/2021)**
- **Simultaneous CPB/CPX measurements (06/2021)**

Action B23 – Prototype characterization

- **CPX measurements** (UNI EIFFEL 04/2021 and IPOOL 06/2021)
- Test site: UNI EIFFEL reference test track in Nantes (France)



PCR
VTAC0/6 with CR

P
VTAC0/6 without CR

E1
reference DAC 0/10

Action B23 – Prototype characterization

- Close-ProXimity (CPX) noise measurements according to ISO 11819-2

Renault Scénic / Michelin Energy Saver 195/60 R15 (UNI EIFFEL)

Mercedes Vito / SRTT P225/60 R16 (ISO 11819-3) (I-POOL)

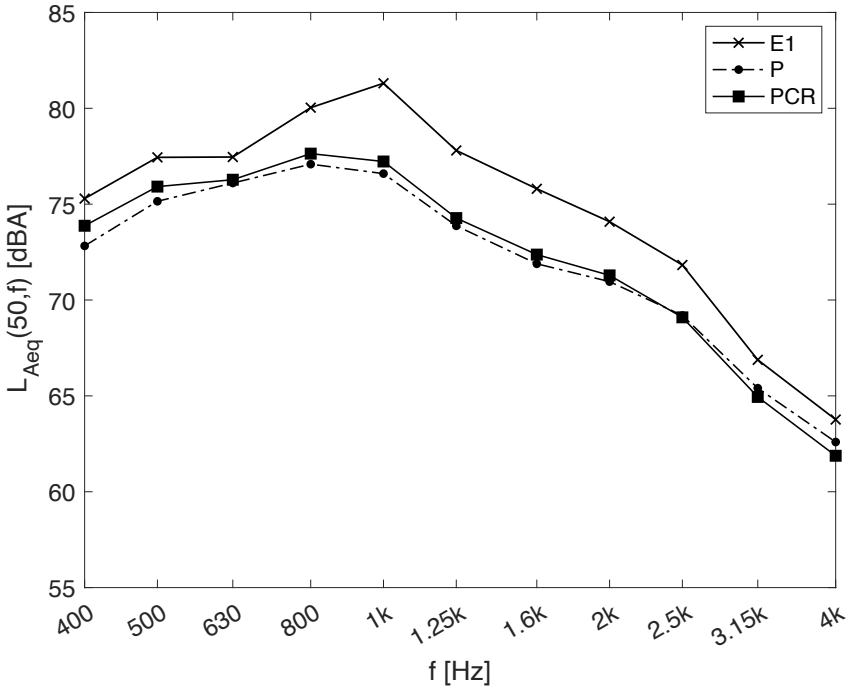
CPX overall noise levels at 50 km/h (corrected at 20°C)

Test section	E1	P	PCR
Michelin Energy Saver 195/60 R15	87.0 dB(A)	84.2 dB(A)	84.6 dB(A)
SRTT P225/60 R16	90.2 dB(A)	88.5 dB(A)	87.8 dB(A)

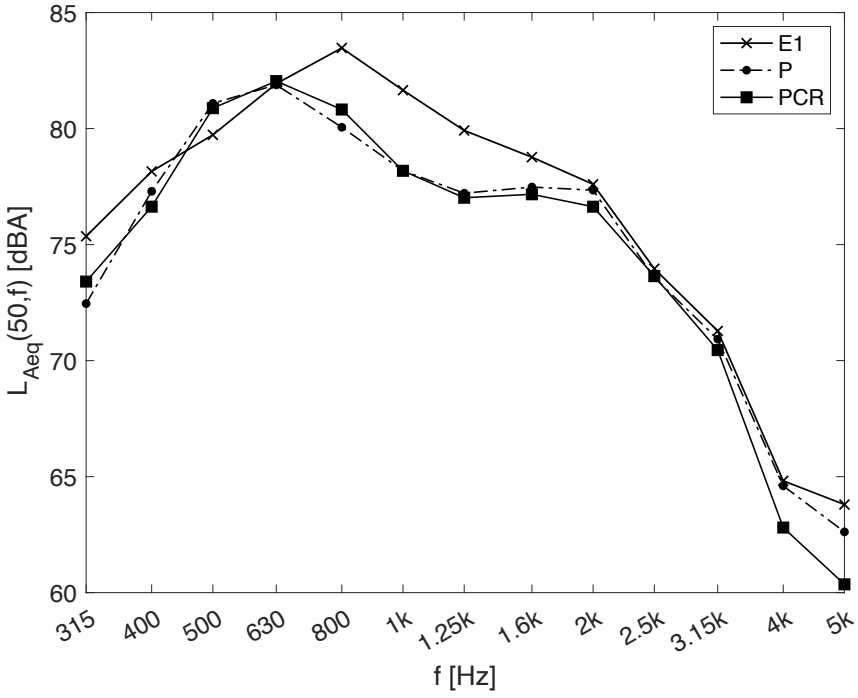
Action B23 – Prototype characterization

- CPX noise spectra at 50 km/h (no temperature correction)

Michelin Energy Saver 195/60 R15



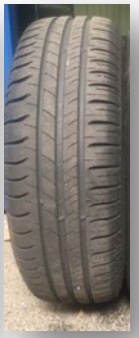
SRTT P225/60 R16



Action B23 – Prototype characterization

- **Simultaneous Coast-By/Close-ProXimity measurements**

Renault Scénic / Michelin Energy Saver 195/60 R15 (UNI EIFFEL)



CB and CPX overall noise levels at 50 km/h (corrected at 20°C)

Surface	Direction	CPX noise level	CB noise level
P	E->W	83.8 dB(A)	62.8 dB(A)
P	W->E	83.8 dB(A)	62.6 dB(A)
PCR	E->W	84.7 dB(A)	62.9 dB(A)
PCR	W->E	84.0 dB(A)	N/A

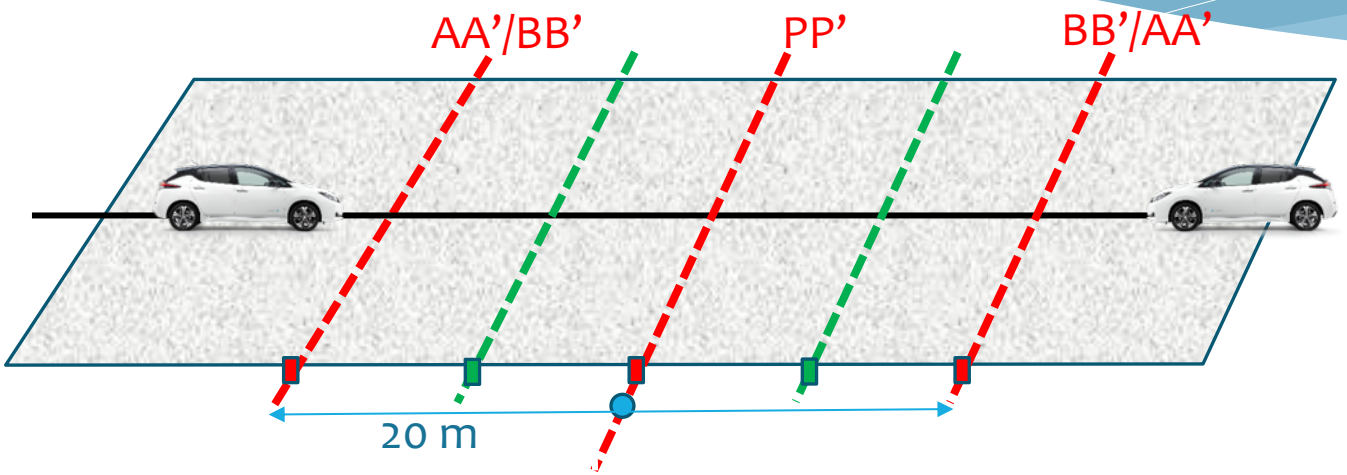
Action B24 – Selection of optimized EV tyres

- Carved prototype tyres delivered by CRD to UNI EIFFEL for testing on the prototypal test surface:
  - 1 set of reference tyres + other tyre sets (variations of tread pattern, construction and/or compound of the reference)
  - Aim: optimizing the balance of exterior noise performance and other tyre performances (e.g. rolling resistance, grip) for EV vehicles

- **Constant speed and accelerated pass-by noise measurements**, according to UNECE R51.03, **on the tyre versions** provided by CRD
  - Pass-by measurements with 1 EV and 1 ICE vehicle fitted with the test tyres
    ⇨ completed in August 2021, results available

- **CPX measurements with the tyre versions** on the prototypal test sections and further standard road surfaces
    ⇨ performed with V1 - V4 (pending for V5 and V6)

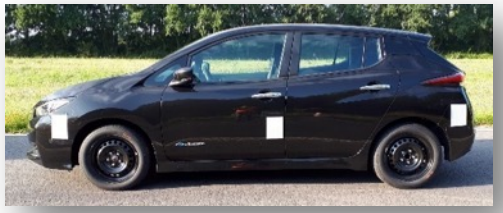
Pass-by measurements according to R51.03 procedure



6 tyre versions designed by CRD in action B7

- **6 tyre versions** designed by CRD in action B7
  - Dimension 205/55 R16
- **2 vehicles**

1 EV
Nissan Leaf

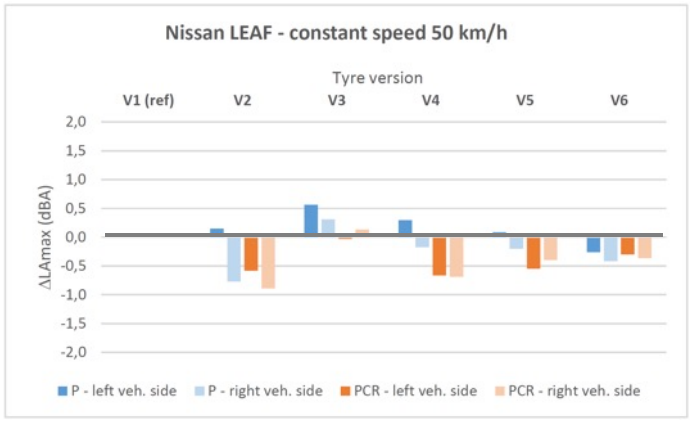


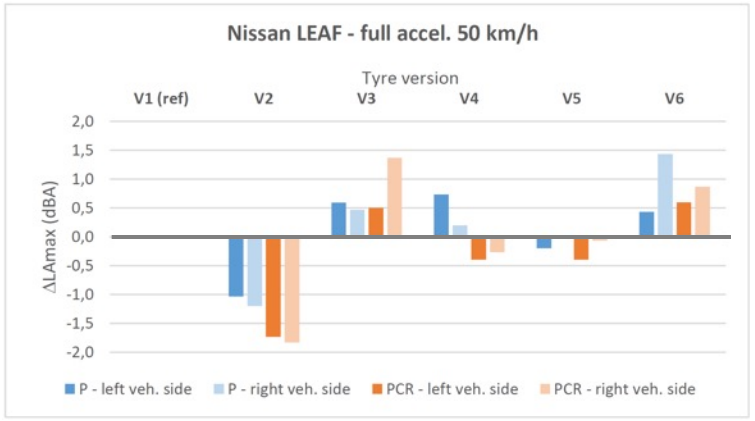
1 ICEV
Renault Kadjar

- **2 pass-by measurement conditions,** in accordance with R51.03
  - Constant speed 50 km/h
  - Full acceleration with 50 km/h when facing the microphone

Example: LEAF – Overall noise levels at 50 km/h

Relatively to reference V1

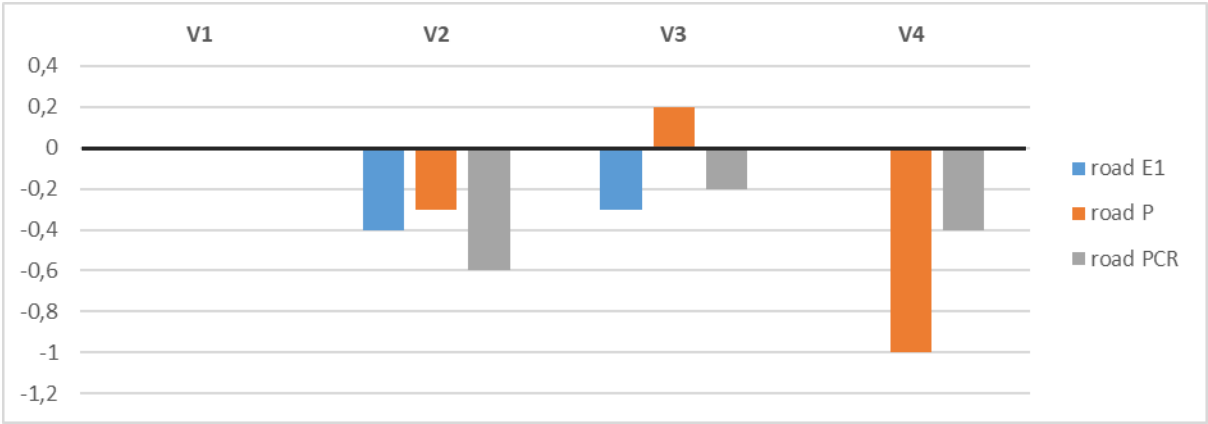




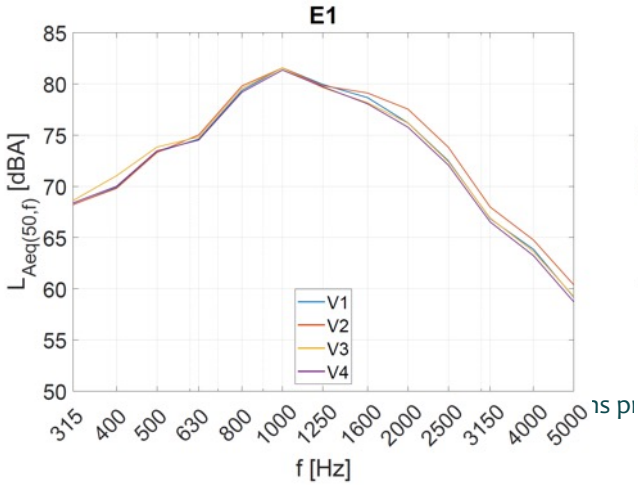
- Increased **tyre effect** under acceleration
- **Tyre comparison** on each road surface
- Highlight on **noise frequency characteristics** with tyre versions
- **Road surface comparison** - On average over the 6 tyre versions:
  - Constant speed 50 km/h: PCR quieter than P by 0.7 dB(A)
  - Full acceleration: PCR quieter than P by 0.4 dB(A)

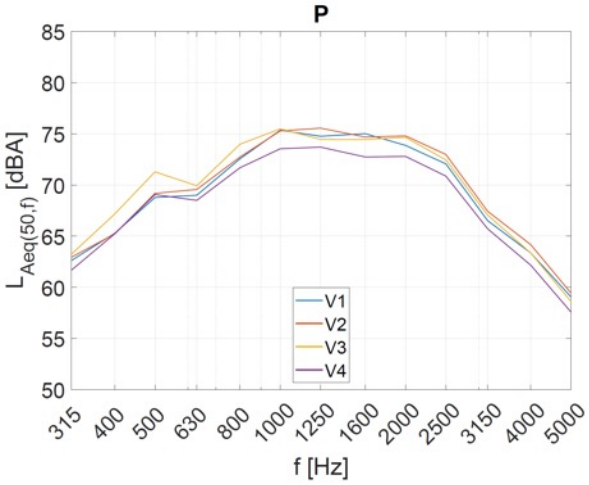
CPX measurements with tyre versions V1 – V4

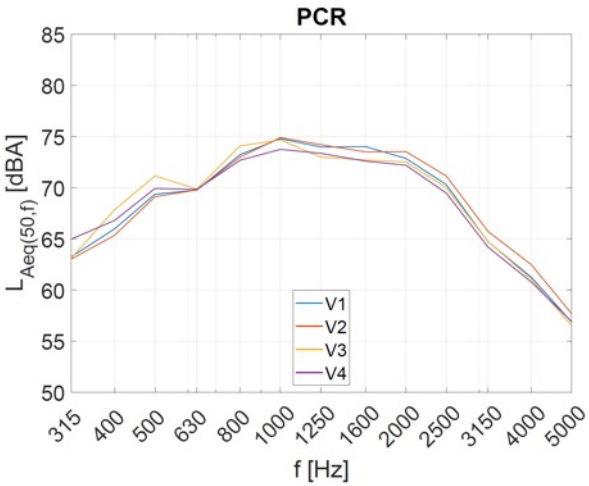
- Overall noise levels measured at 50 km/h: difference with V1 (ref.)



- Spectra measured at 50 km/h







Action B4 – Track efficiency tests in the pilot area

- Contribution of UNI EIFFEL to the measurement campaign in Florence (cf. IPOOL presentation for details):
  - 3D texture and dynamic stiffness static measurements
  - Performed in October 2021 (during the night)

Dissemination Actions D1 and D2

- Sub-action D1-3:
  - Deliverable name: Video of the prototype construction (action D1 – June 2021)

    Title: **Low-noise road surface prototype for electric vehicles**
- Sub-action D2-2:
  - J. Cesbron, M-A. Pallas, P. Klein, S. Bianchetti, A. Le Bellec and V. Gary, « LIFE E-VIA : contrôle du bruit des véhicules électriques par optimisation de l'interaction pneumatique-chaussée », Journées Techniques Acoustique et Vibrations, Lille, France, 2020
  - J. Cesbron, S. Bianchetti, M-A. Pallas , A. Le Bellec, V. Gary and P. Klein, Road surface influence on electric vehicle noise emission at urban speed, Noise Mapping, vol. 8(1), 217-227, 2021
  - J. Cesbron, S. Bianchetti, M-A. Pallas, A. Le Bellec, V. Gary and P. Klein, Influence du revêtement de chaussée sur l'émission sonore des véhicules électriques (projet LIFE E-VIA), Journées Techniques Acoustique et Vibrations 2021 (on-line seminar)
  - J. Cesbron, S. Bianchetti, M-A. Pallas, F. Pratico, R. Fedele, G. Pellicano, A. Moro, F. Bianco, Acoustical characterization of low-noise prototype asphalt concretes for electric vehicles, Euronoise 2021 (e-Congress)
  - M.-A. Pallas *et al.*, « LIFE E-VIA: Prototypal low-noise road surface for the reduction of electric vehicle rolling noise in urban area », PIARC, International Sustainability of Road Transport: Air pollution, Noise & Relationship with Energy Transition and Climate Change, Cluj-Napoca, Romania, oct. 2021 (on-line)

Milestones and Deliverables

Milestones

Action	Name	Expected Date	Achieved
B2	B2 Tyre-pavement coupling study - Prototype realization	09/2021	Yes (09/2021)

Deliverables

Action	Name	Expected Date	Achieved
A1	Technical Report Actions A1,A2,A3	03/2020	Yes (12/06/2020)
B2	B2 Report on prototype implementation and tyre/road noise performances	11/2021	No (exp. 04/03/2022)
D1	5 noticeboards in French language	12/2022	Draft (05/2021)
D1	Video of the prototype construction	12/2021	Yes (06/2021)
D2	17 different scientific papers to be presented in national / international congresses	03/2023	1 JTAV2020, 1 JTAV 2021, 1 Euronoise 2021, 1 PIARC 2021, 1 CFA 2022, 1 IN2022
D2	1 Article Published in an open access top ranked journal	12/2022	1 Noise Mapping Journal 2021

Thank you for your attention

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- Link:
  - http://www.umrae.fr/

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The **Joint Research Unit in Environmental Acoustics** (UMRAE) is a research laboratory common to Ifsttar and Cerema

E-VIA LIFE 18 ENV/IT/000201

MONITORING MEETING
25 FEBRUARY 2022

ACTION PROGRESS
B4, B6

ACTIONS

- **B4** - TRACK EFFICIENCY TESTS IN THE PILOT AREA
  IN PROGRESS
  - **SUB ACTION B4.1** – B1 - ROAD SURFACE CHARACTERIZATION
  - **SUB ACTION B4.2** – ACOUSTICAL CHARACTERIZATION OF EVs
- **B6** – EVALUATION OF EV NOISE EMISSIONS
  IN PROGRESS
  - **SUB ACTION B6.1** - CNOSSOS MODEL PARAMETERS FOR EV VEHICLES
  - **SUB ACTION B6.2** - CALCULATION OF THE ROAD SURFACE PROPERTIES WITHIN THE CNOSSOS MODEL
- CONCLUSIONS
  - B4 PROGRESS STATUS
  - B6 PROGRESS STATUS
  - DISSEMINATION

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ACTION B4 - Track efficiency tests in the pilot area

ACTION OVERVIEW

iPOOL	CPX (ISO 11819-2) Extended Surface(ISO 13472-1) Impedance Tube (ISO 13472-2)	**Sub-action B4.1** 4 measurement sessions
iPOOL	CPB (NF S 31-119-2) SPB (ISO 11819-1)	**Sub-action B4.2** 2 measurement sessions (CPB only)
Université Gustave Eiffel	Pavement 3D texture Impact hammer	**Sub-action B4.1**

Milestone	B4 New road surfaces efficiency test	08/2022
Deliverable	**B4 Report**	**10/2022**

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SUB-ACTION B4.1

TEST SITE *(Via Paisiello, Florence)*

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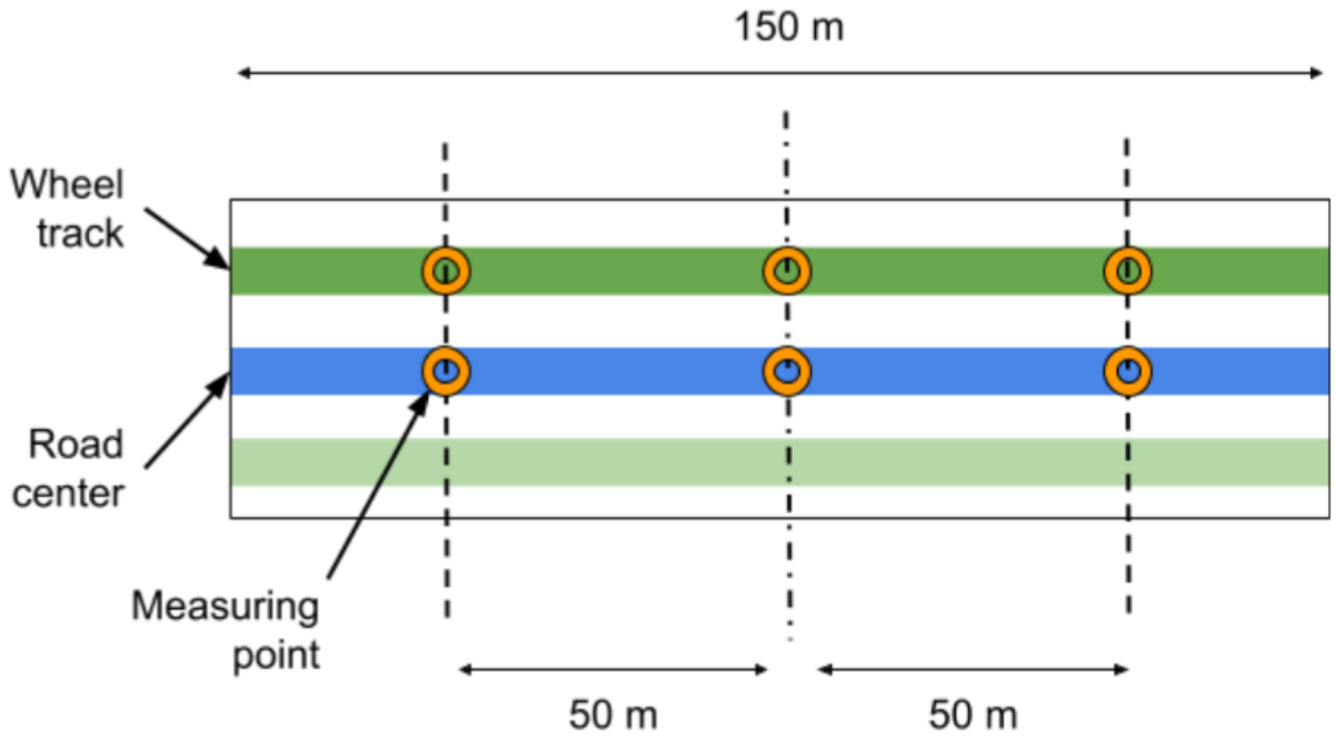
SUB-ACTION B4.1

MEASUREMENT PLAN *(Via Paisiello, Florence)*



Extended Surface(ISO 13472-1)
Impedance Tube (ISO 13472-2)

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SUB-ACTION B4.1

MEASUREMENT PLAN *(Via Paisiello, Florence)*

- 3D texture and dynamic stiffness static measurements
- Performed in October 2021 (during the night)

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SUB-ACTION B4.1

MEASUREMENT PLAN *(Via Paisiello, Florence)*

- 3D texture measurement system
- Same procedure as performed in Nantes on the prototype

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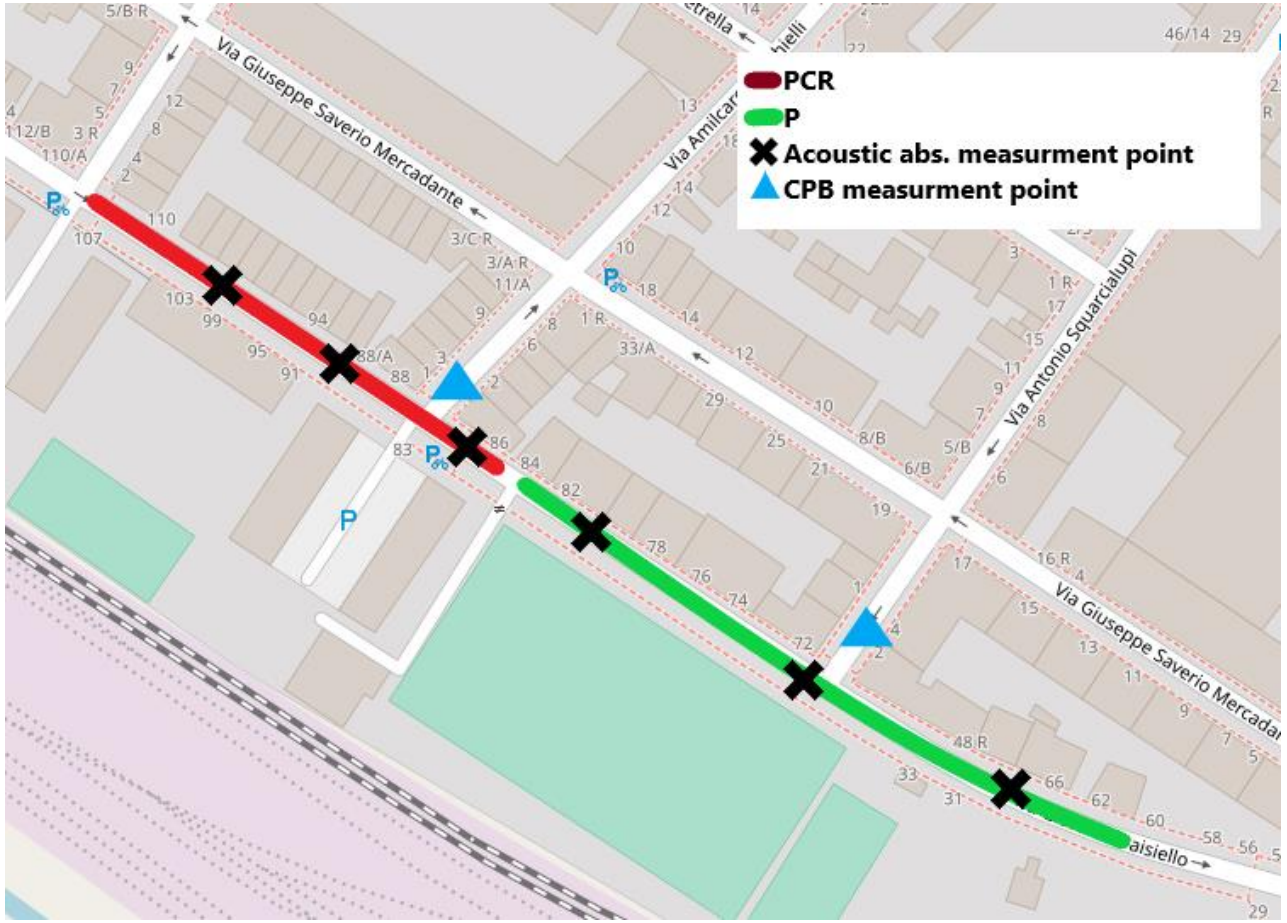
SUB-ACTION B4.1

MEASUREMENT PLAN *(Via Paisiello, Florence)*



For each acoustic absorption measurement point both the wheel track and center lane are evaluated.

CPB is measured in two position, 7.5 m (1.2 m height) and 15 m (2.4 m height) from the center lane.

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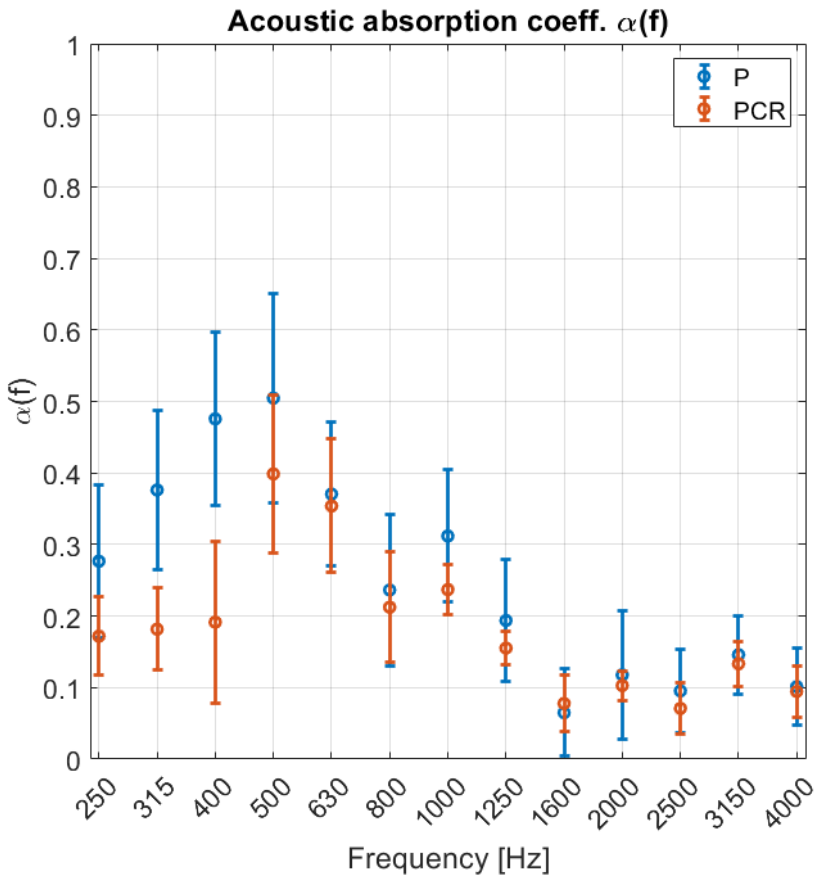
SUB-ACTION B4.1

EXTENDED SURFACE MEASUREMENTS

Aggregated data with confidence intervals



For each measuring points a direct and a total (direct + reflected) field were acquired

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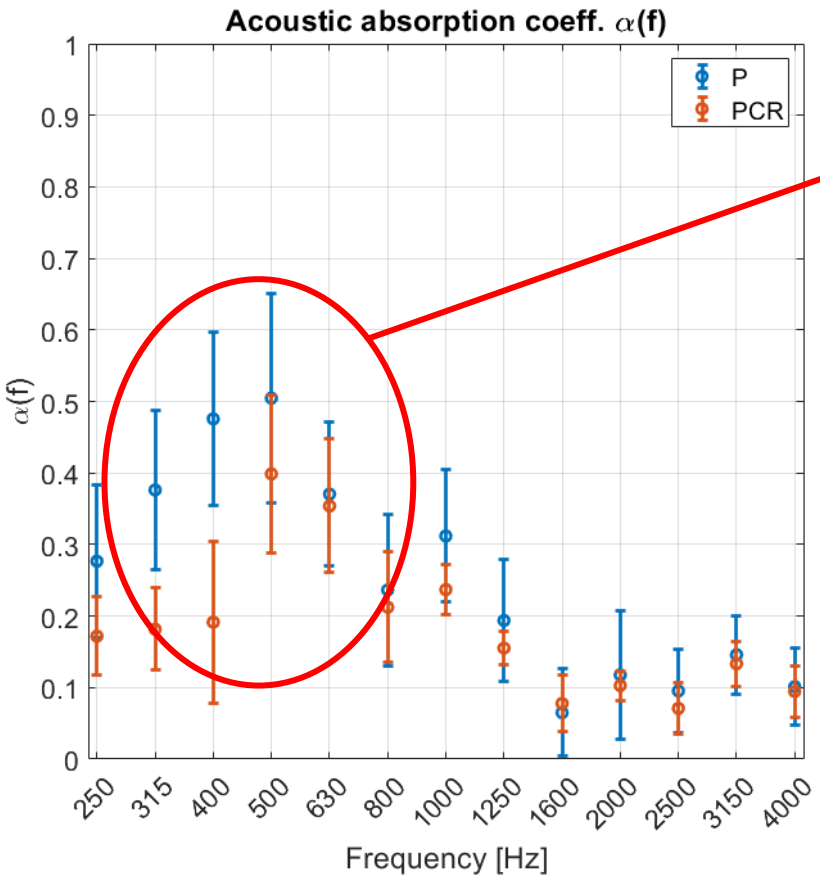
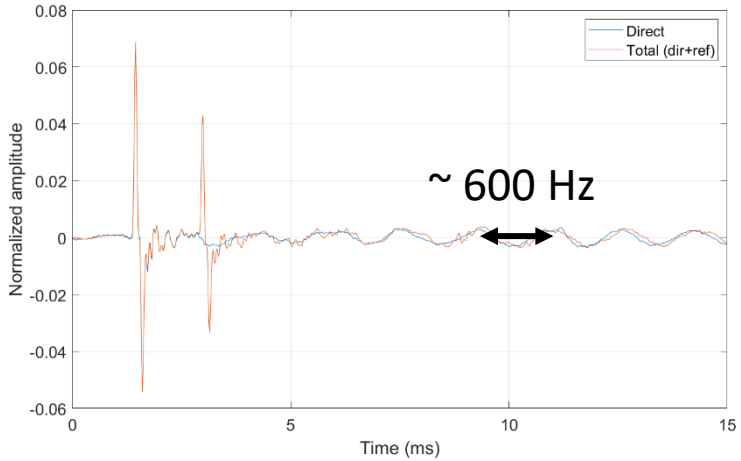
SUB-ACTION B4.1

EXTENDED SURFACE MEASUREMENTS

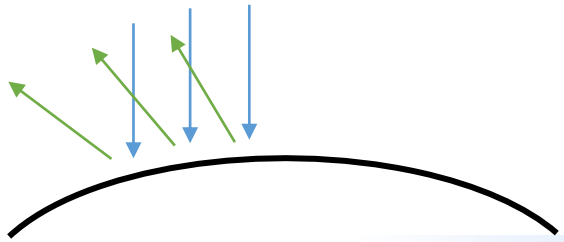
Aggregated data with confidence intervals



1 – Low S/N in low frequency bands



2 – Diffraction/dispersion from uneven surface



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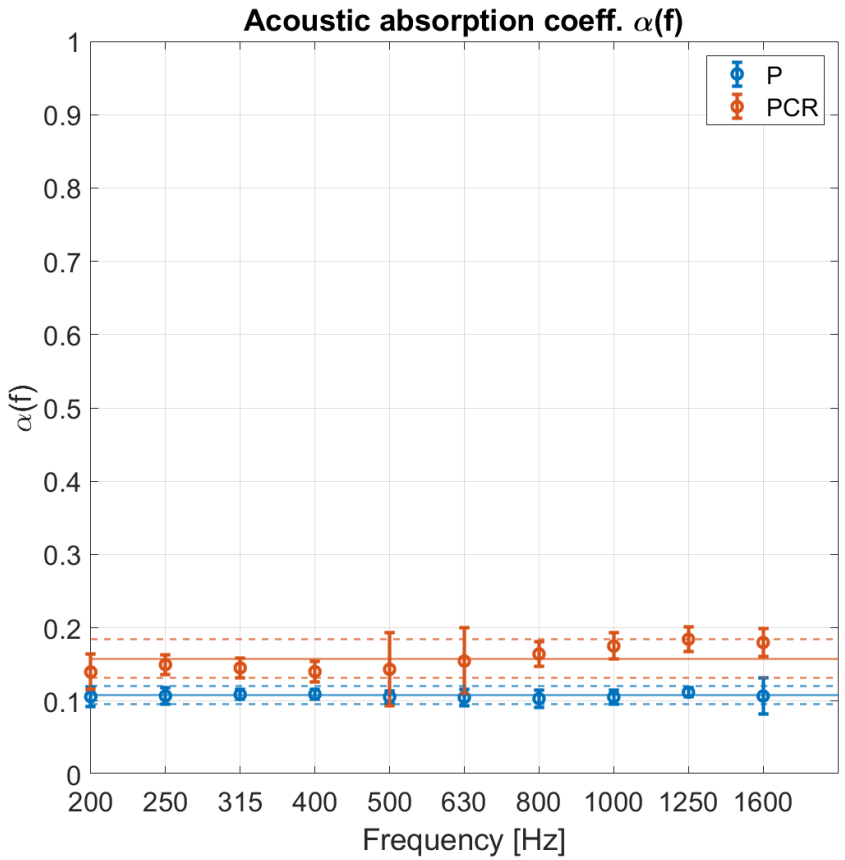
Impedance Tube

Aggregated data with confidence intervals



Measurement are corrected for intrinsic losses, using data from a reflecting slab

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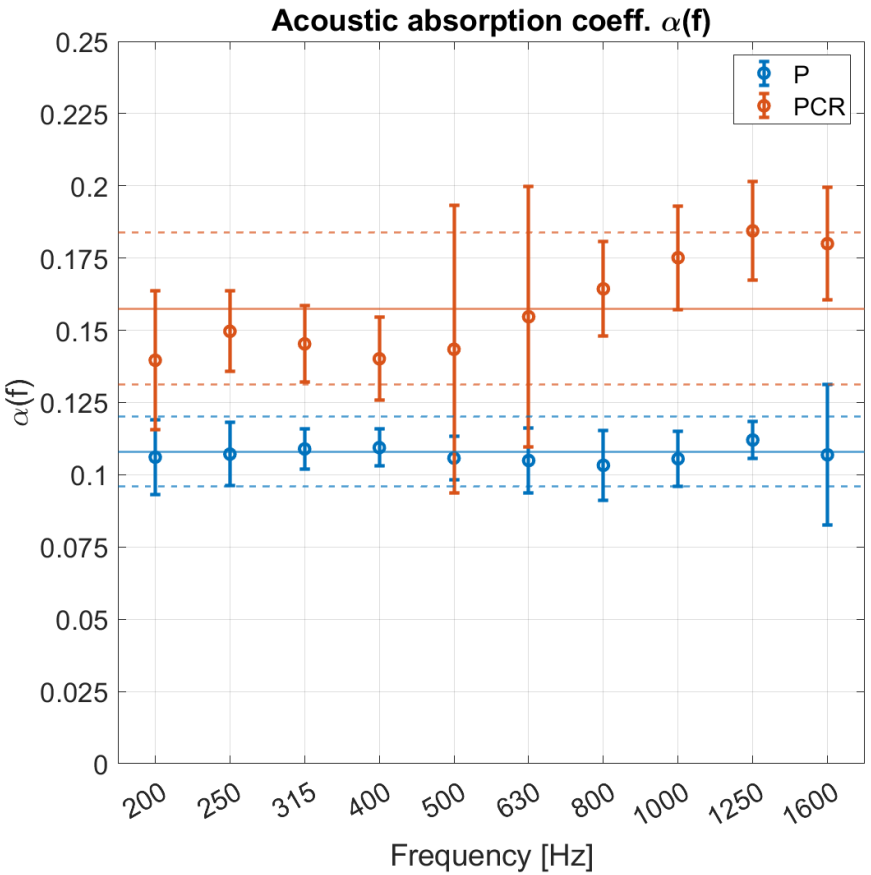
SUB-ACTION B4.1

Impedance Tube

Aggregated data with confidence intervals



Surface	P	PCR
Mean absorption	**0.108 ± 0.012**	**0.158 ± 0.026**

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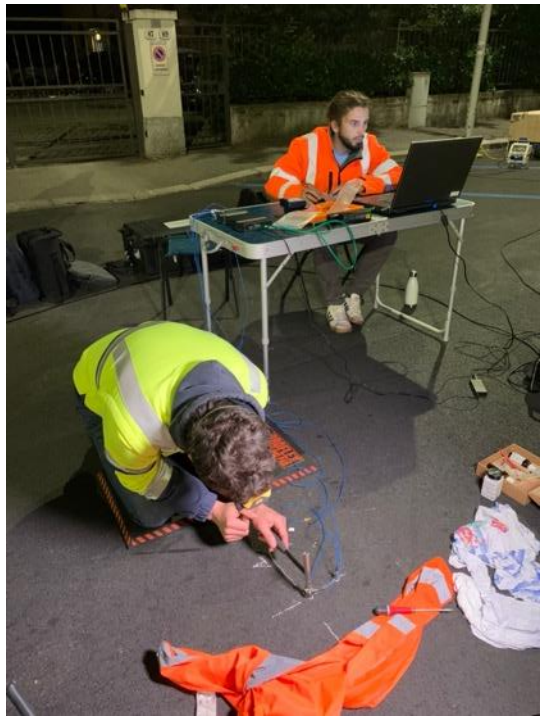
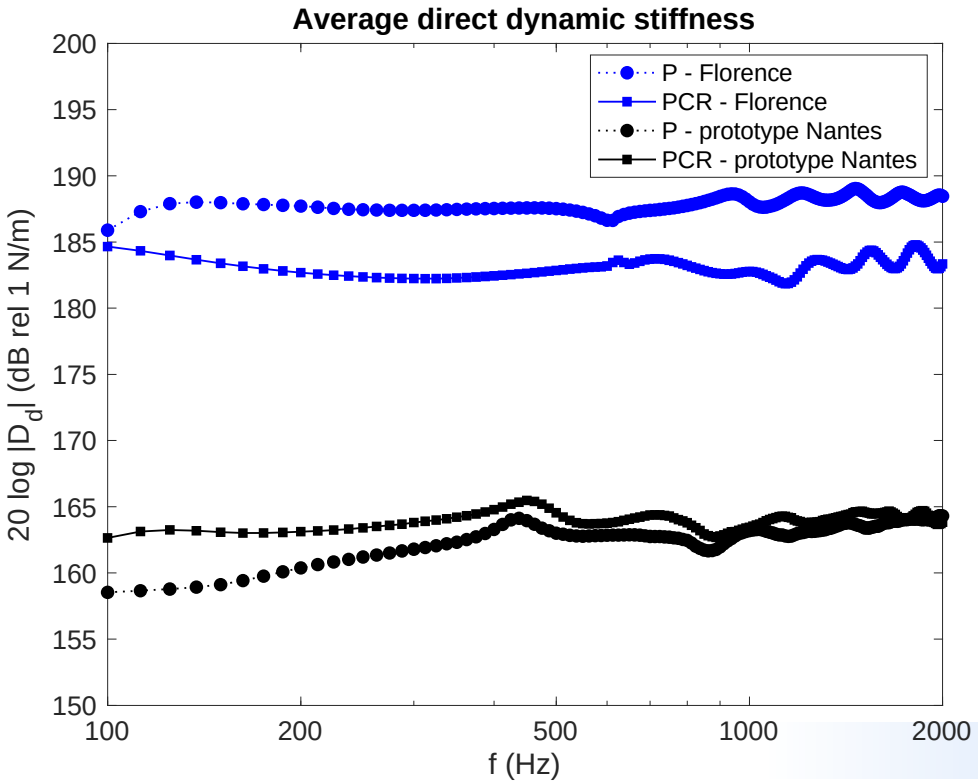
SUB-ACTION B4.1

Impact Hammer

- Dynamic stiffness: same measurement procedure than in Nantes on the prototype
- Dynamic stiffness higher in Florence than in Nantes (could be due to lower temperature)
- In Florence, P stiffer than PCR (and inversely in Nantes but slighter difference)





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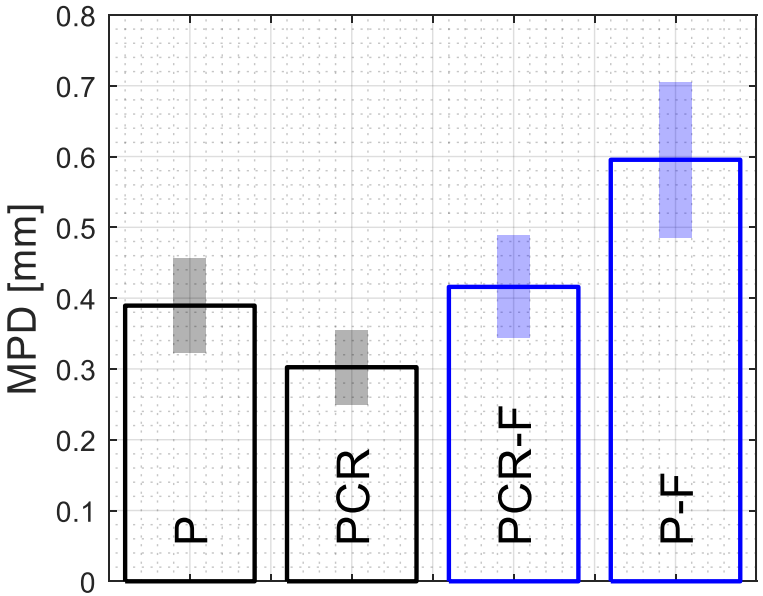
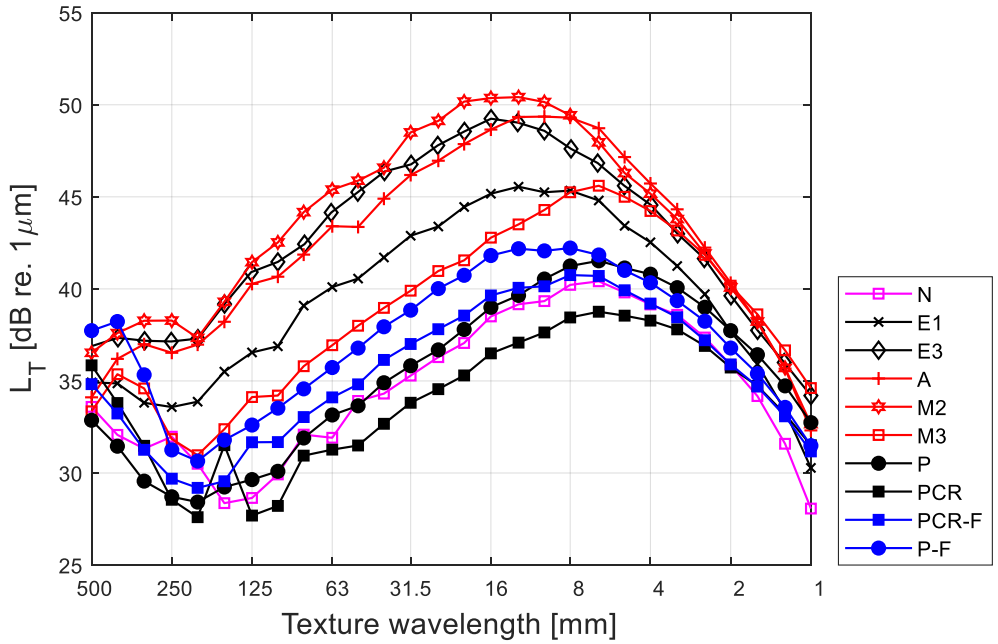
SUB-ACTION B4.1

3D Texture

- MPD is higher in Florence than in Nantes (but remains low for both test sections)
- Texture levels are higher in Florence than in Nantes (but remain low)





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Close Proximity Index - ICEVs

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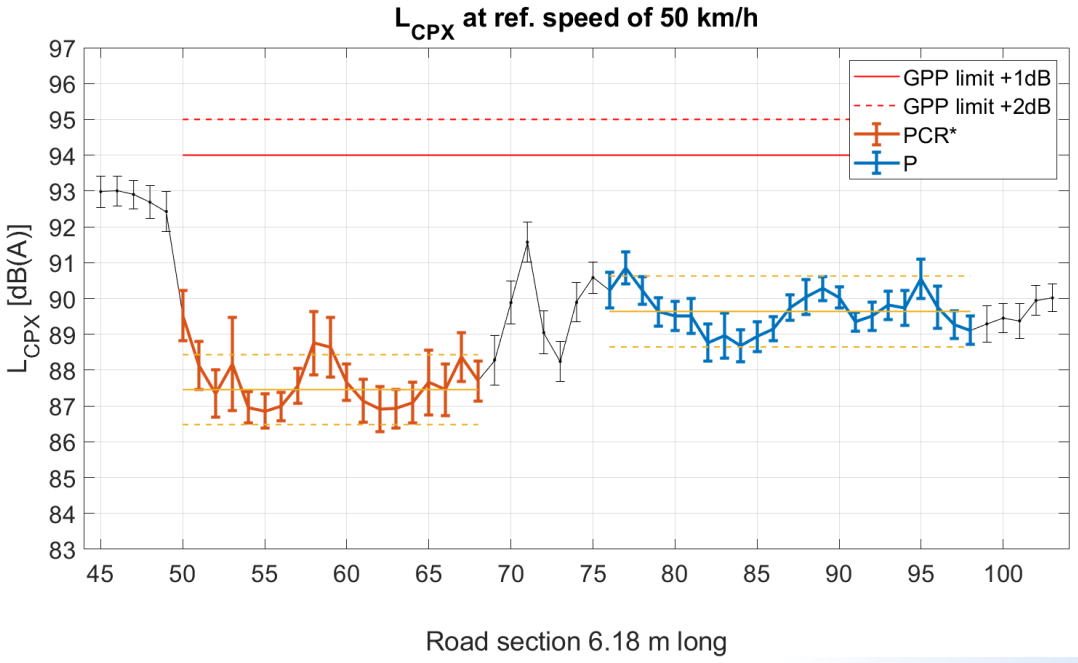
Close Proximity Index - ICEVs

In addition to the standard CPX evaluation, the multifit method was used to better study the dependence of noise emission with speed. Values were normalized to an air temperature of 20°C and tyre hardness equal to 66 Shore(A)



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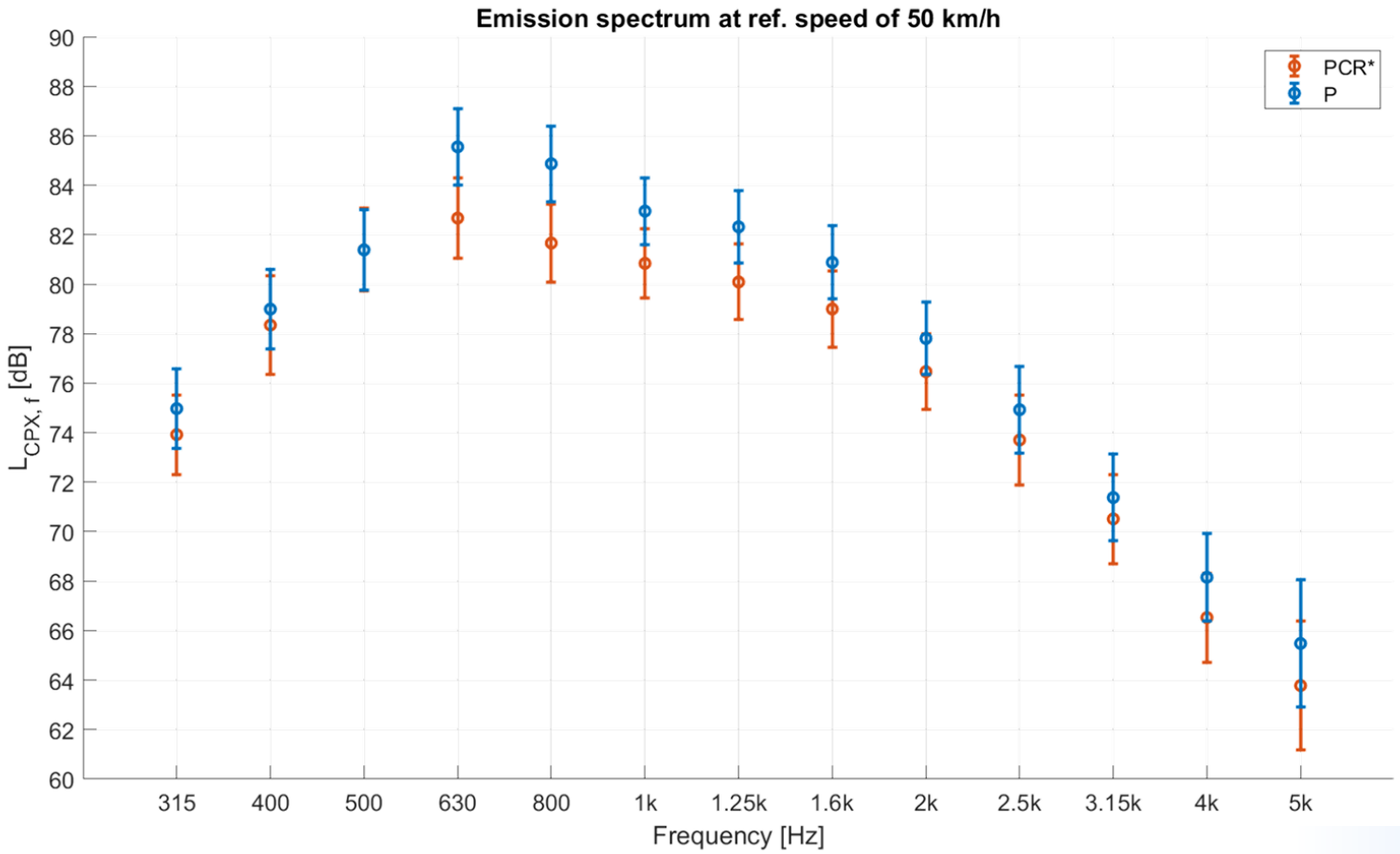
Close Proximity Index - ICEVs



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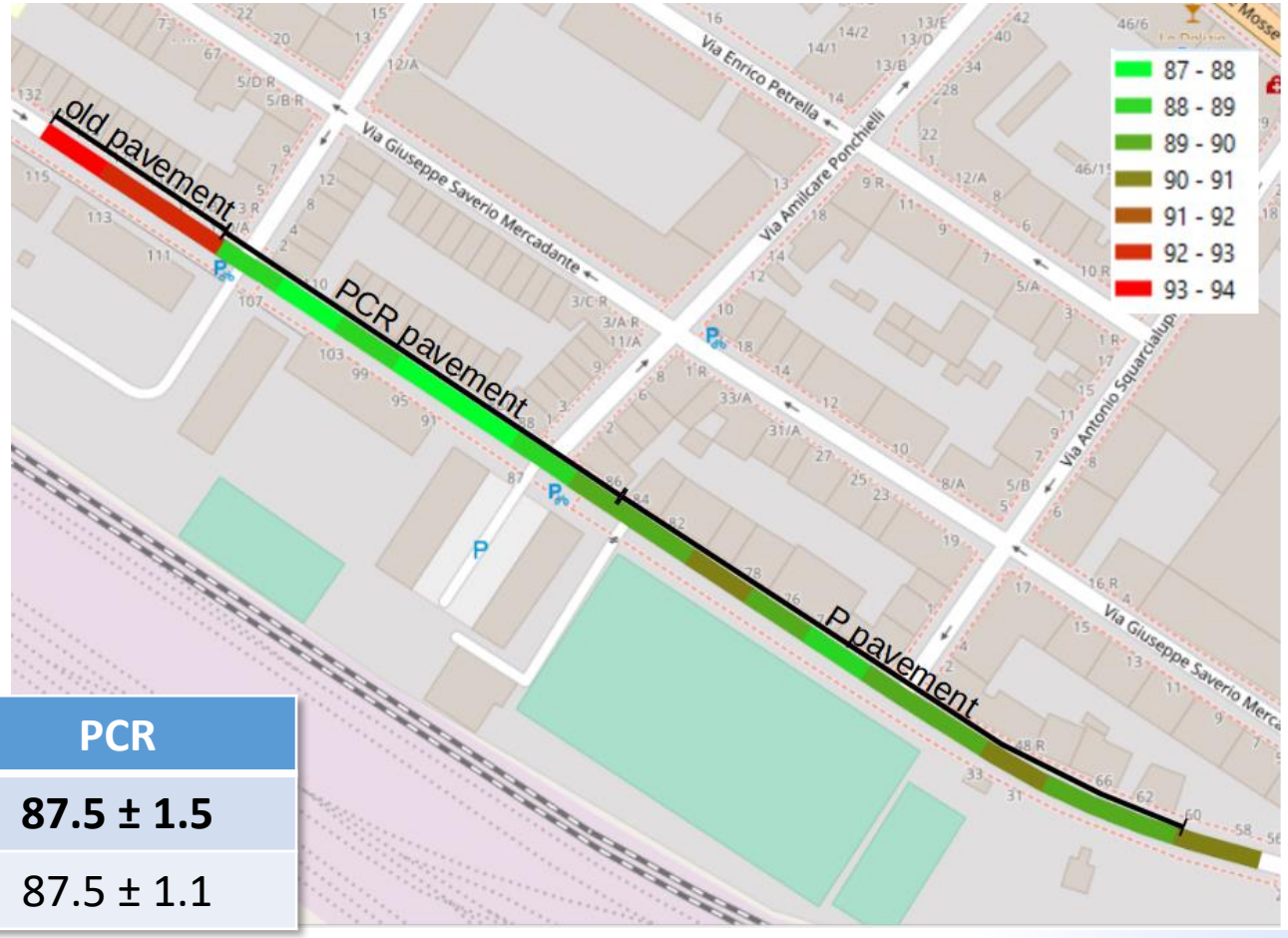
Close Proximity Index - ICEVs



Lcpx @ 50km/h [dBA]

	P	PCR
Firenze	**89.6 ± 1.1**	**87.5 ± 1.5**
Nantes	88.1 ± 0.9	87.5 ± 1.1

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Controlled Pass By - EVs

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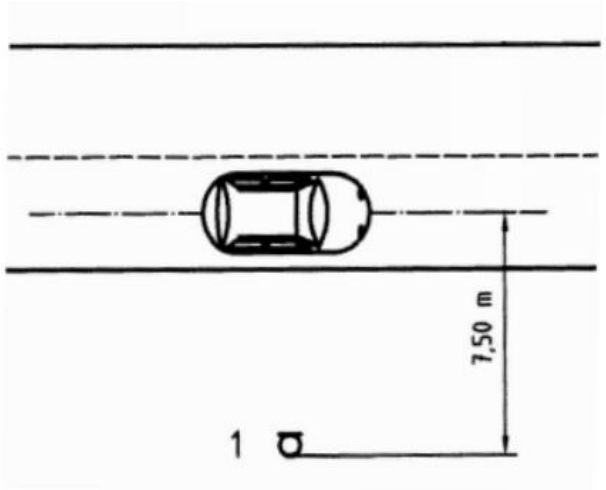
Controlled Pass By - EVs

Several Pass-by events were recorded in the two CPB points, at several speeds.

SLM were placed according to the figure below



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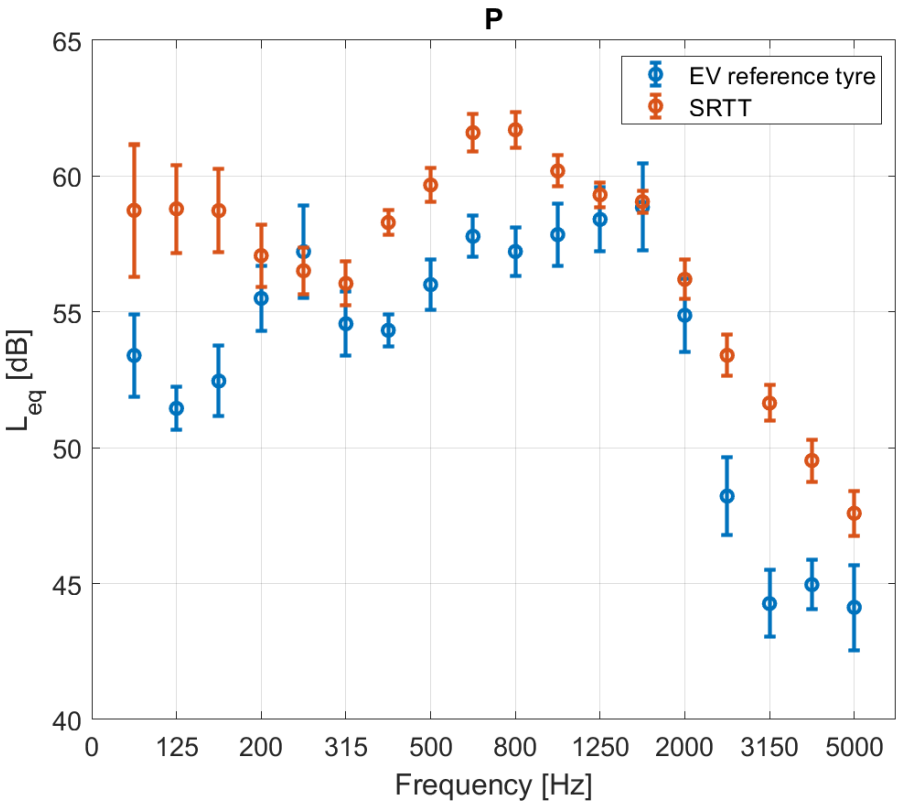
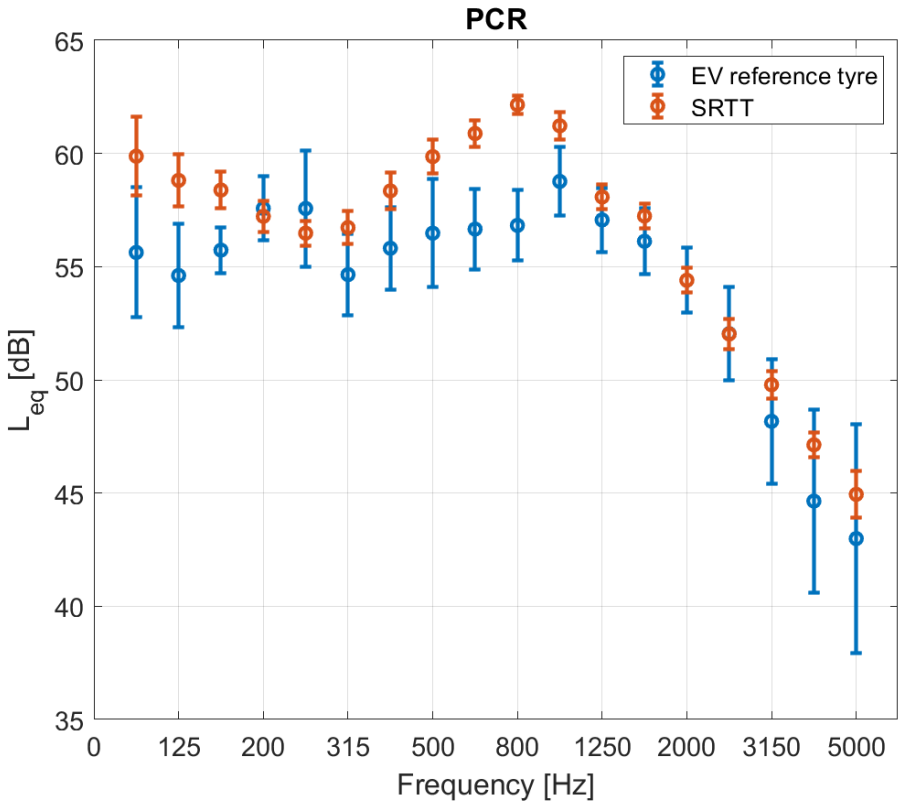
Controlled Pass By - EVs





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Controlled Pass By - EVs

Firenze - Lcpb @50km/h [dBA]

	P	PCR
EV	**65.4 ± 1.1**	**65.2 ± 1.4**
SRTT	67.9 ± 0.4	67.4 ± 0.4

Nantes - Lcpb @50km/h [dBA]

	P	PCR
SRTT	66.8 ± 0.3	66.8 ± 0.4

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ACTION B6 – Evaluation of EV noise emissions

ACTION OVERVIEW

Université Gustave Eiffel

iPOOL TECHNOLOGY COMPANY DESIGN MATERIAL

Comune di Firenze

Sub-action B6.1
EV rolling noise CNOSSOS coefficients for the reference surface. ICEV rolling and engine noise analysis.

Sub-action B6.2
Evaluation of $\Delta L_{wr,road}$ for the test track. EV and ICEV comparison for test track EV effectiveness

Sub-action B6.3
Noise mapping for inhabitants' exposure (Lden and Lnight as KPI)

Sub-action B6.4
Guideline for Regional and National pavement replacement policy

Milestone	B6 Guidelines issuing	09/2022
Deliverable	**B6 Report**	**09/2022**
	Guideline about the use and application of the methodology output	**09/2022**

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SUB-ACTION B6.1

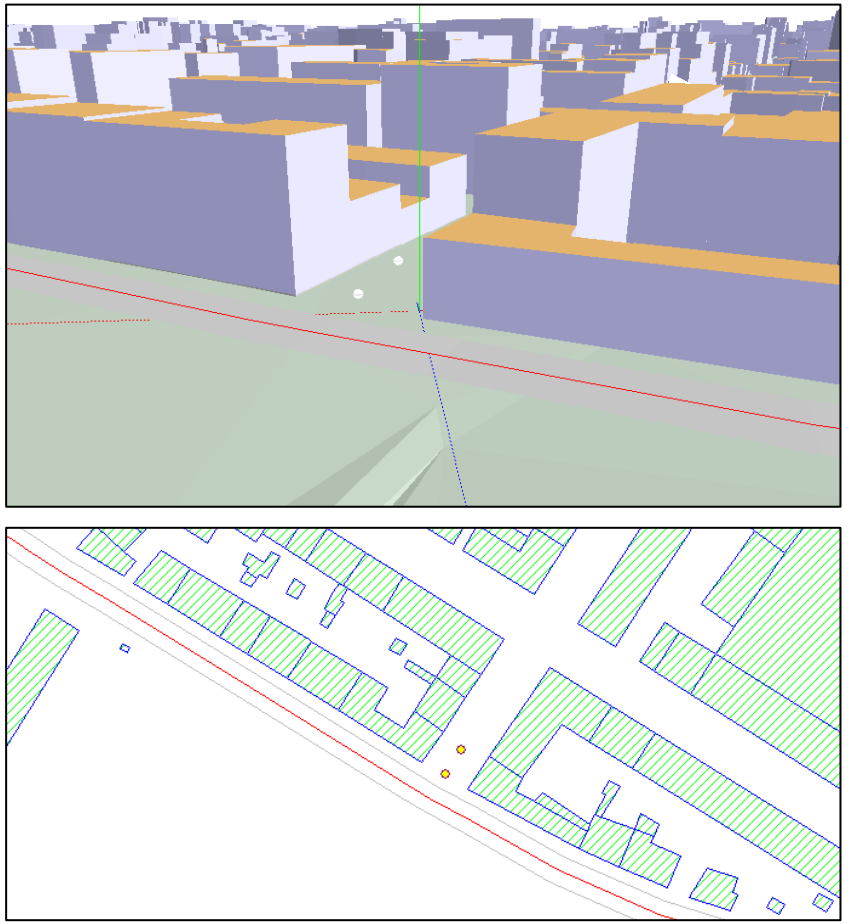
CNOSSOS model parameters for EV vehicles

A framework was created in order to obtain CNOSSOS model parameters for EV vehicles.

The process started from the data obtained by CPB with an EV vehicle with standard wheels.

Supposing the reference track as a standard reference surface in the model, the parameters of the vehicle emission can be derived using the equations provided by the COMMISSION DIRECTIVE (EU) 2015/996:

$$L_{W,EV} = L_{WR,EV} = A_{EV} + B_{EV}\ log\left(\frac{v_{EV}}{v_{ref}}\right) + \Delta L_{WR,EV}$$



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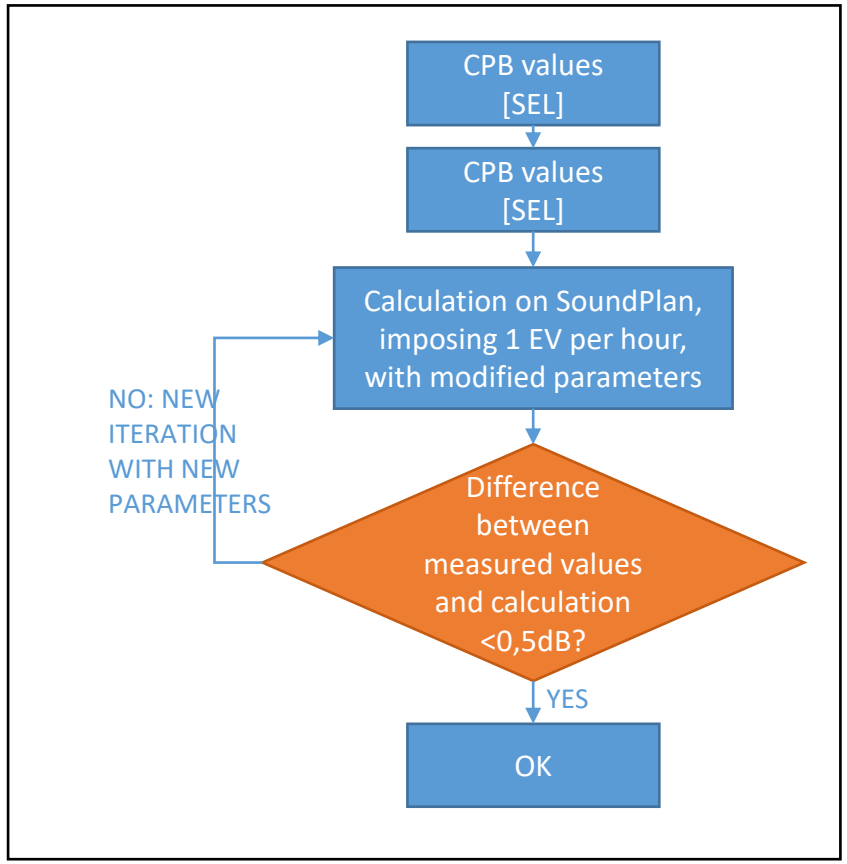
CNOSSOS model parameters for EV vehicles



A new category was created in the CNOSSOS database.

The difference between the values measured with the CPB method and the values derived from the calculation on software with the CNOSSOS methodology were calculated iteratively.

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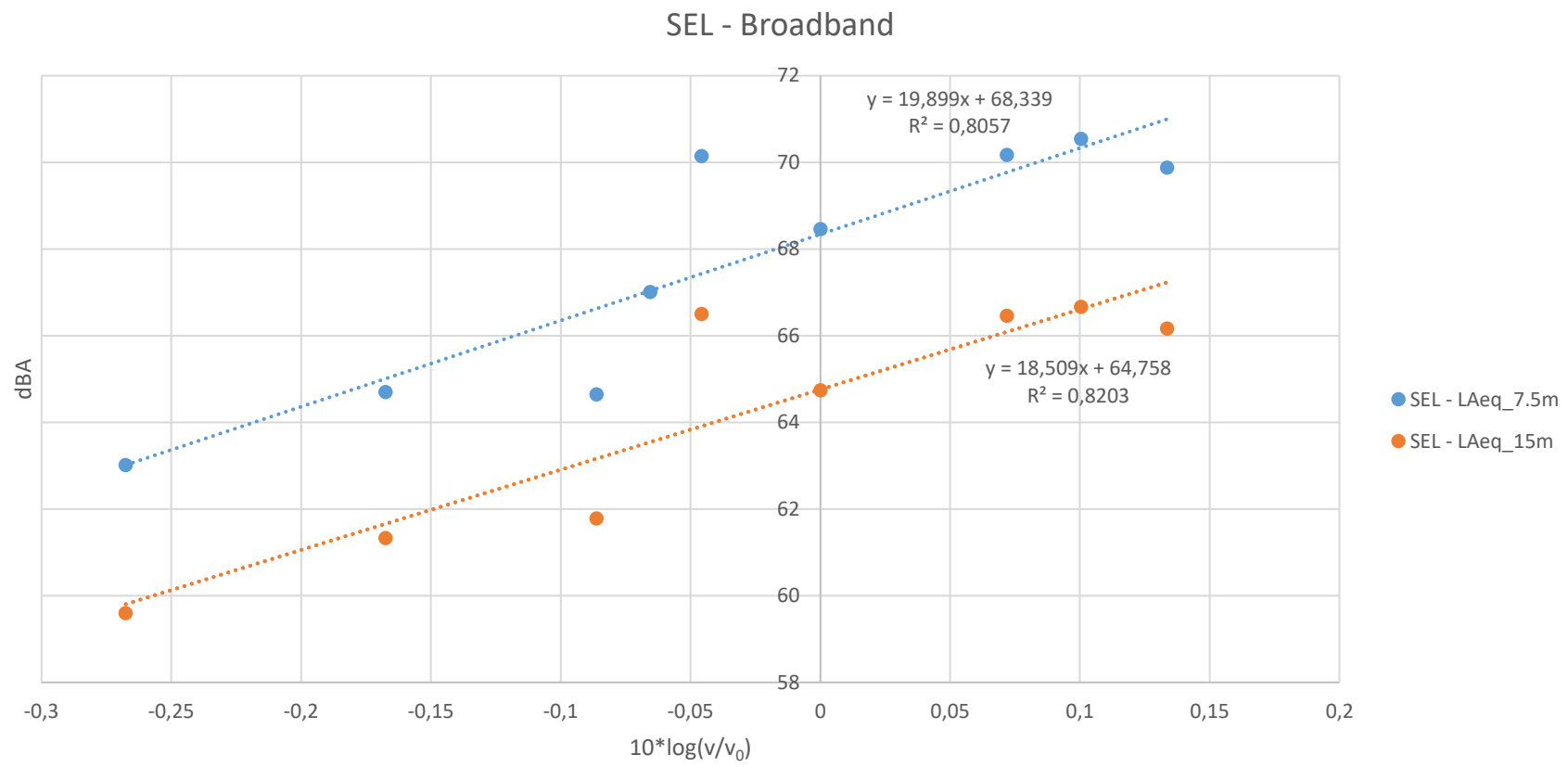
CNOSSOS model parameters for EV vehicles



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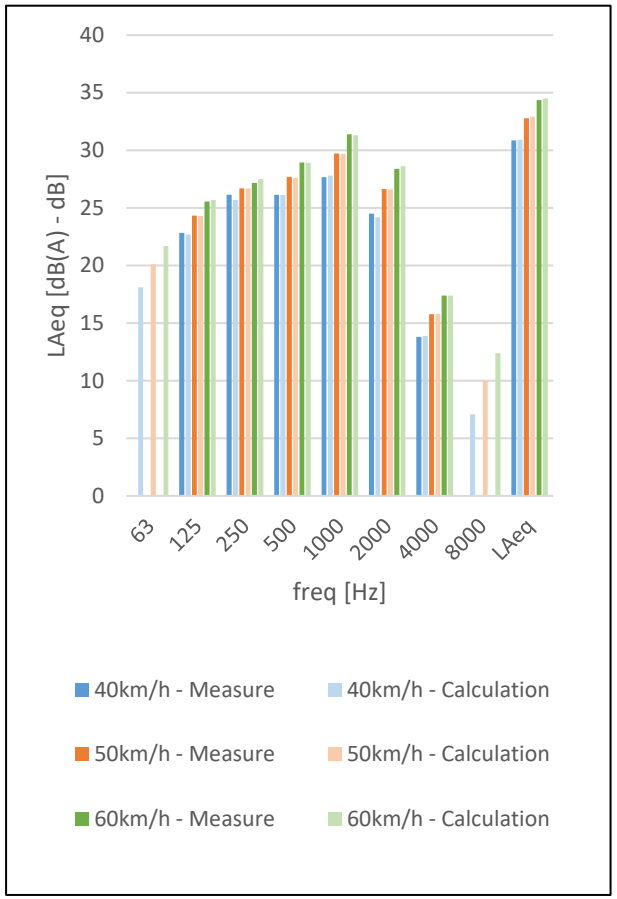
CNOSSOS model parameters for EV vehicles



Mesaurements [SEL, dB(A) - dB] - 7.5m									
vel [km/h]	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	***SEL***
40	-	58,4	61,7	61,7	63,2	60,0	49,4	-	***66,4***
50	-	59,9	62,3	63,2	65,3	62,2	51,4	-	***68,3***
60	-	61,1	62,7	64,5	67,0	63,9	53,0	-	***69,9***
Mesaurements [LAeq, dB(A) - dB] - 7.5m									
vel [km/h]	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	***LAeq***
40	-	22,8	26,1	26,1	27,7	24,5	13,8	-	***30,8***
50	-	24,3	26,7	27,7	29,7	26,6	15,8	-	***32,8***
60	-	25,6	27,2	28,9	31,4	28,4	17,4	-	***34,4***
Calculation SoundPlan [LAeq, dB(A) - dB] - 7.5m									
vel [km/h]	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	***LAeq***
40	18,1	22,7	25,7	26,1	27,8	24,2	13,9	7,1	***30,9***
50	20,1	24,3	26,7	27,6	29,7	26,6	15,8	10	***32,9***
60	21,7	25,7	27,5	28,9	31,3	28,6	17,4	12,4	***34,5***
DELTA Mesaurements - Calculations [LAeq, dB(A) - dB] - 7.5m									
vel [km/h]	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	***LAeq***
40	-	-0,1	-0,4	0,0	0,1	-0,3	0,1	-	***0,1***
50	-	0,0	0,0	-0,1	0,0	0,0	0,0	-	***0,1***
60	-	0,1	0,3	0,0	-0,1	0,2	0,0	-	***0,1***

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SUB-ACTION B6.1

CNOSSOS model parameters for EV vehicles

CNOSSOS 2021/2015 - SoundPlan 8.2							
Hz	aR	bR	aP	bP	ai	bi	Km
63	83,1	30,0	0,0	0,0	0,0	0,0	0,08
125	87,0	27,0	0,0	0,0	0,0	0,0	0,08
250	88,3	20,0	0,0	0,0	0,0	0,0	0,08
500	90,1	25,7	0,0	0,0	2,6	-3,1	0,08
1000	93,1	30,0	0,0	0,0	2,9	-6,4	0,08
2000	91,0	35,0	0,0	0,0	1,5	-14,0	0,08
4000	79,6	30,0	0,0	0,0	2,3	-22,4	0,08
8000	76,2	40,0	0,0	0,0	9,2	-11,4	0,08

As you can see, only rolling noise (aR, bR) has been taken in account

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SUB-ACTION B6.2

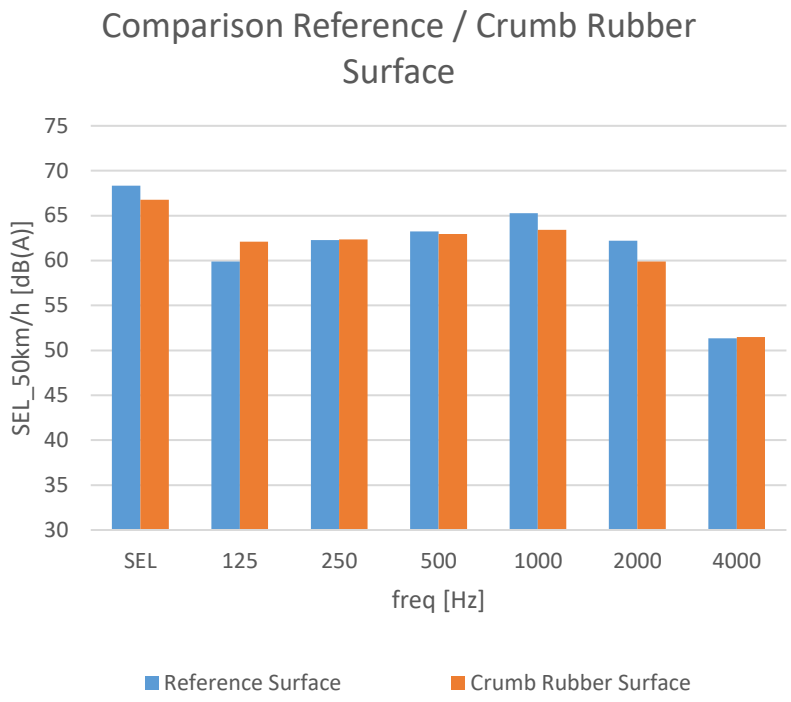
Calculation of the road surface properties within the CNOSSOS model

This sub-action deals with the calculation of the road surface properties within the CNOSSOS model.
The effects are evaluated from a single EV vehicle but will be further studied when an EV fleet will be at disposal.

The optimized surface $\Delta L_{WR,EV}$ road component, $\Delta L_{WR,road\ EV}$ is evaluated in a similar framework as Sub Action B6.1 using an analogous dataset from measurements performed in via Paisiello.

This component shares the same functional dependency with speed as the vehicle component:

$$\Delta L_{WR,road\ EV} = \alpha_{EV} + \beta_{EV}\ log\left(\frac{v_{EV}}{v_{ref}}\right)$$



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SUB-ACTION B6.2

Calculation of the road surface properties within the CNOSSOS model

Mesaurements [SEL, dB(A) - dB] - 7.5m									
vel [km/h]	63	125	250	500	1000	2000	4000	8000	***SEL***
40	-	60,1	61,3	61,5	61,1	57,3	49,4	-	***64,7***
50	-	62,1	62,3	63,0	63,4	59,9	51,5	-	***66,8***
60	-	63,7	63,2	64,2	65,3	62,0	53,2	-	***68,4***
Mesaurements [LAeq, dB(A) - dB] - 7.5m									
vel [km/h]	63	125	250	500	1000	2000	4000	8000	***LAeq***
40	-	24,6	25,8	25,9	25,5	21,7	13,8	-	***29,1***
50	-	26,5	26,8	27,4	27,8	24,3	15,9	-	***31,2***
60	-	28,2	27,6	28,6	29,8	26,4	17,6	-	***32,9***
Calculation SoundPlan [LAeq, dB(A) - dB] - 7.5m									
vel [km/h]	63	125	250	500	1000	2000	4000	8000	***LAeq***
40	18,1	24,9	25,7	26,1	25,9	21,9	13,9	7,1	***29,5***
50	20,1	26,5	26,7	27,6	27,8	24,3	15,8	10	***31,4***
60	21,7	27,9	27,5	28,9	29,4	26,3	17,4	12,4	***33***
DELTA Mesaurements - Calculations [LAeq, dB(A) - dB] - 7.5m									
vel [km/h]	63	125	250	500	1000	2000	4000	8000	***LAeq***
40	-	0,3	-0,1	0,2	0,4	0,2	0,1	-	***0,4***
50	-	0,0	-0,1	0,2	0,0	0,0	-0,1	-	***0,2***
60	-	-0,3	-0,1	0,3	-0,4	-0,1	-0,2	-	***0,1***

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SUB-ACTION B6.2

Calculation of the road surface properties within the CNOSSOS model

$\Delta L_{W,R,road\ EV}$ CNOSSOS Coefficient											
Veh.Cat.	Vmin km/h	Vmax km/h	alpham 63	alpham 125	alpham 250	alpham 500	alpham 1000	alpham 2000	alpham 4000	alpham 8000	betam
EV	**20**	**130**	**0**	**2,2**	**0**	**0**	**-1,9**	**-2,3**	**0**	**0**	**0**

For Crumb Rubber road surface, calculated on EVs, we have a slight increase in noise at 125Hz, while a decrease is observed in the 1000 and 2000Hz octave bands.

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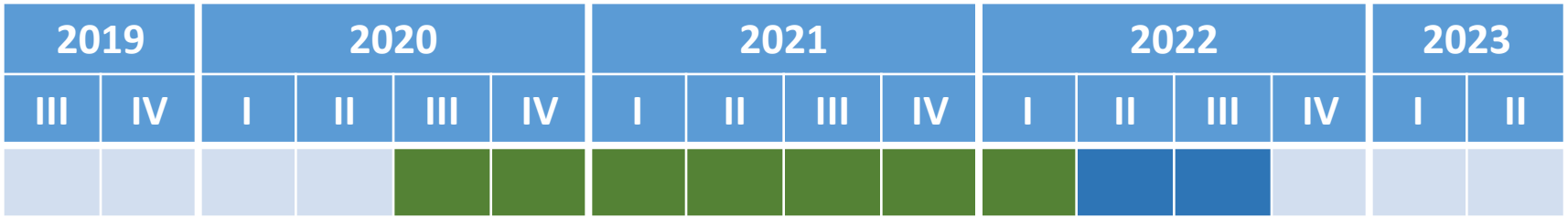
ACTION PROGRESS – B4



The progress done for action B4 is well within initial project's expectations, so no delay is foreseen for the next steps. Further research is possible beyond the initial project's drafting.

WHAT'S LEFT?

- Further analysis on experimental tires, aging/durability…
- Third and fourth measurement session
- B4 Report

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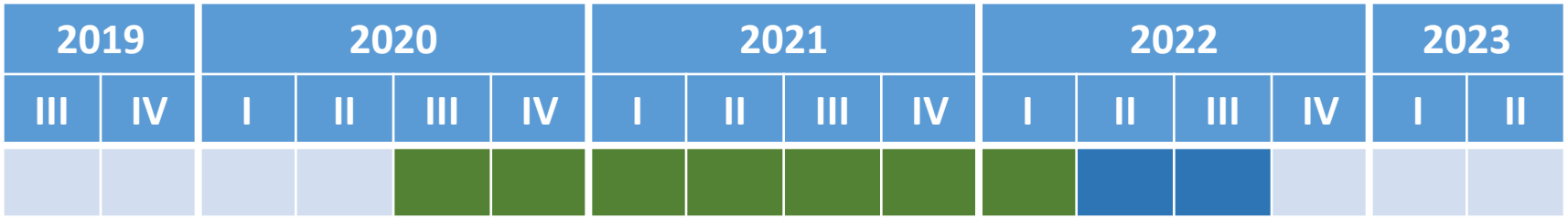
ACTION PROGRESS – B6



The progress done for action B6 is well within initial project's expectations, so no delay is foreseen for the next steps. Further research is possible beyond the initial project's drafting.

WHAT'S LEFT?

- Further analysis on ICEV CPB, aging/durability…
- EV SPB
- Noise mapping and population exposure
- B6 Report
- B6 Guidelines

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DISSEMINATION

RAR 2022

Malaga, 26-29 June 2022

Experimental comparison of the acoustic performance of rubberized and conventional road surfaces

Lara Ginevra Del Pizzo, Gloria Schiaffino, Francesco Bianco, Antonino Moro, Stefano Carpita, Filippo Praticò, Julien Cesbron, Gaetano Licitra

CONCLUSIONS

THANKS FOR YOUR ATTENTION!

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marie-agnes.pallas@univ-eiffel.fr
adrien.le-bellec@univ-eiffel.fr
francesco.bianco@i-pool.it
lara.delpizzo@i-pool.it
antonino.moro@i-pool.it
fabio.brocchi@i-pool.it

LINKS:

http://www.umrae.fr/
https://www.ipoolsrl.com/

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LIFE E-VIA

Electric **V**ehicle no**I**se control by **A**ssessment and optimisation of tyre/ road interaction

www.life-evia.eu

LIFE E-VIA PROJECT

Monitoring visit 25TH February 2022 - Firenze

Vienrose Ingegneria

Responsible for actions B5, D1 and D2

Raffaella Bellomini, Sergio Luzzi, **Chiara Bartalucci**, Sara Delle Macchie, Lucia Busa, **Francesco Borchi**, Gianfrancesco Colucci, Giulia Iannuzzi

With the contribution of the LIFE programme of the European Union

LIFE18 ENV/IT/000201

ACTION B5

Change in one of the activities planned under Action B5:

B5.1 Soundwalks and interview ✓

B5.2 Interview in the pilot road on an electric taxi ✓

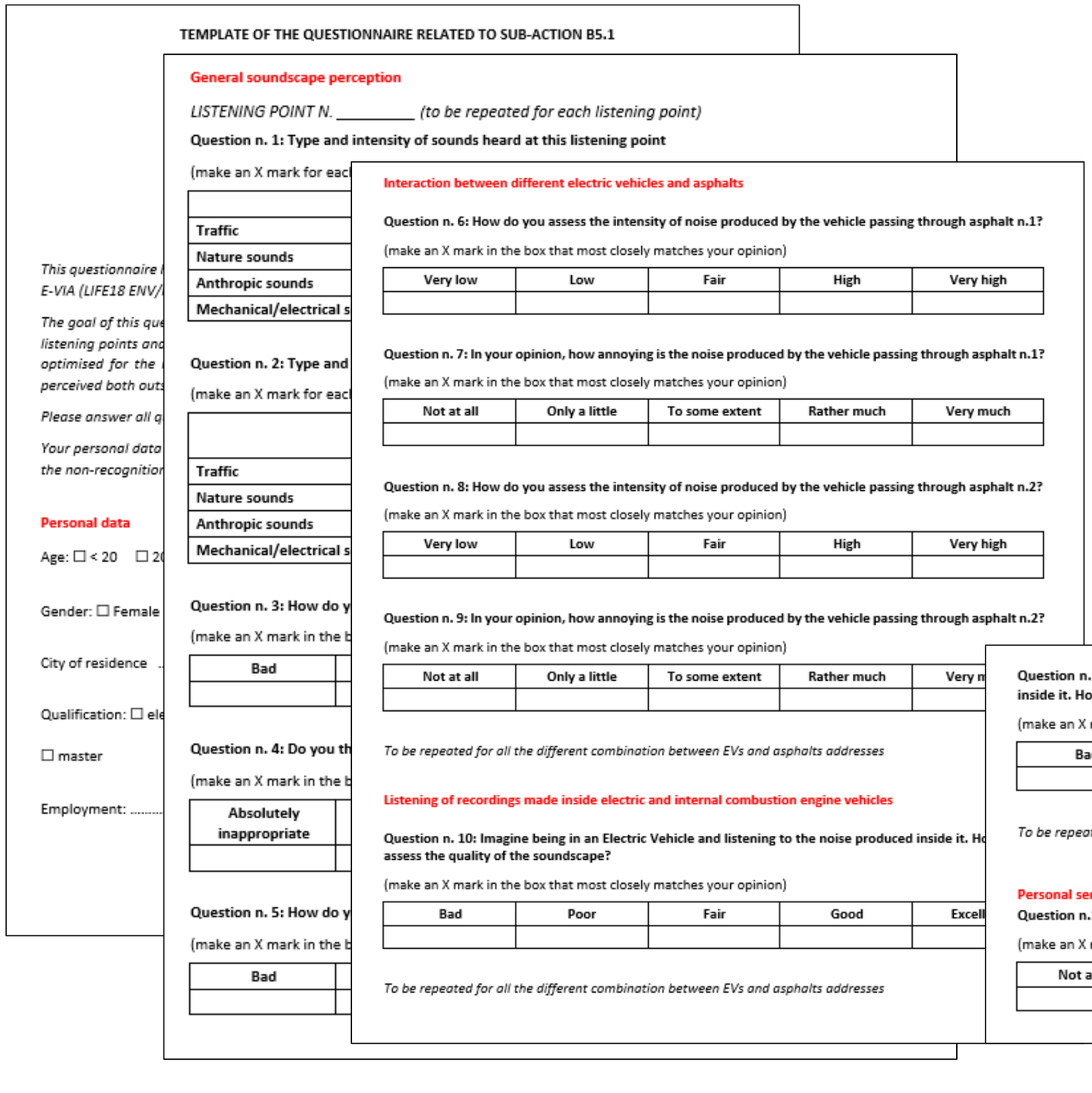
B5.3 Interview on EV concerning different road pavements

↓

B5.3 Ante- and post-operam interviews with residents ✓

LIFE18 ENV/IT/000201
LIFE E-VIA PROJECT
25 February 2022 - Vie en.ro.se Ingegneria

B5.1 Soundwalks and interview



TEMPLATE OF THE QUESTIONNAIRE RELATED TO SUB-ACTION B5.1

This questionnaire
E-VIA (LIFE18 ENV/

The goal of this que
listening points and
optimised for the
perceived both outs

Please answer all q

Your personal data
the non-recognition

Personal data

Age: ☐ < 20 ☐ 2

Gender: ☐ Female

City of residence

Qualification: ☐ ele

☐ master

Employment: .....

General soundscape perception

LISTENING POINT N. _____ (to be repeated for each listening point)

Question n. 1: Type and intensity of sounds heard at this listening point

(make an X mark for eac

Traffic	
Nature sounds	
Anthropic sounds	
Mechanical/electrical s	

Question n. 2: Type and

(make an X mark for eac

Traffic	
Nature sounds	
Anthropic sounds	
Mechanical/electrical s	

Question n. 3: How do y

(make an X mark in the b

Bad	

Question n. 4: Do you th

(make an X mark in the b

Absolutely inappropriate	

Question n. 5: How do y

(make an X mark in the b

Bad	

Interaction between different electric vehicles and asphalts

Question n. 6: How do you assess the intensity of noise produced by the vehicle passing through asphalt n.1?

(make an X mark in the box that most closely matches your opinion)

Very low	Low	Fair	High	Very high

Question n. 7: In your opinion, how annoying is the noise produced by the vehicle passing through asphalt n.1?

(make an X mark in the box that most closely matches your opinion)

Not at all	Only a little	To some extent	Rather much	Very much

Question n. 8: How do you assess the intensity of noise produced by the vehicle passing through asphalt n.2?

(make an X mark in the box that most closely matches your opinion)

Very low	Low	Fair	High	Very high

Question n. 9: In your opinion, how annoying is the noise produced by the vehicle passing through asphalt n.2?

(make an X mark in the box that most closely matches your opinion)

Not at all	Only a little	To some extent	Rather much	Very n

To be repeated for all the different combination between EVs and asphalts addresses

Listening of recordings made inside electric and internal combustion engine vehicles

Question n. 10: Imagine being in an Electric Vehicle and listening to the noise produced inside it. Ho assess the quality of the soundscape?

(make an X mark in the box that most closely matches your opinion)

Bad	Poor	Fair	Good	Excell

To be repeated for all the different combination between EVs and asphalts addresses

Question n. 11: Imagine being in an Internal Combustion Engine Vehicle and listening to the noise produced inside it. How do you assess the quality of the soundscape?

(make an X mark in the box that most closely matches your opinion)

Bad	Poor	Fair	Good	Excellent

To be repeated for all the different combination between ICEVs and asphalts addresses

Personal sensibility

Question n.12: Do you feel sensitive to noise?

(make an X mark in the box that most closely matches your opinion)

Not at all	Only a little	To some extent	Rather much	Very much

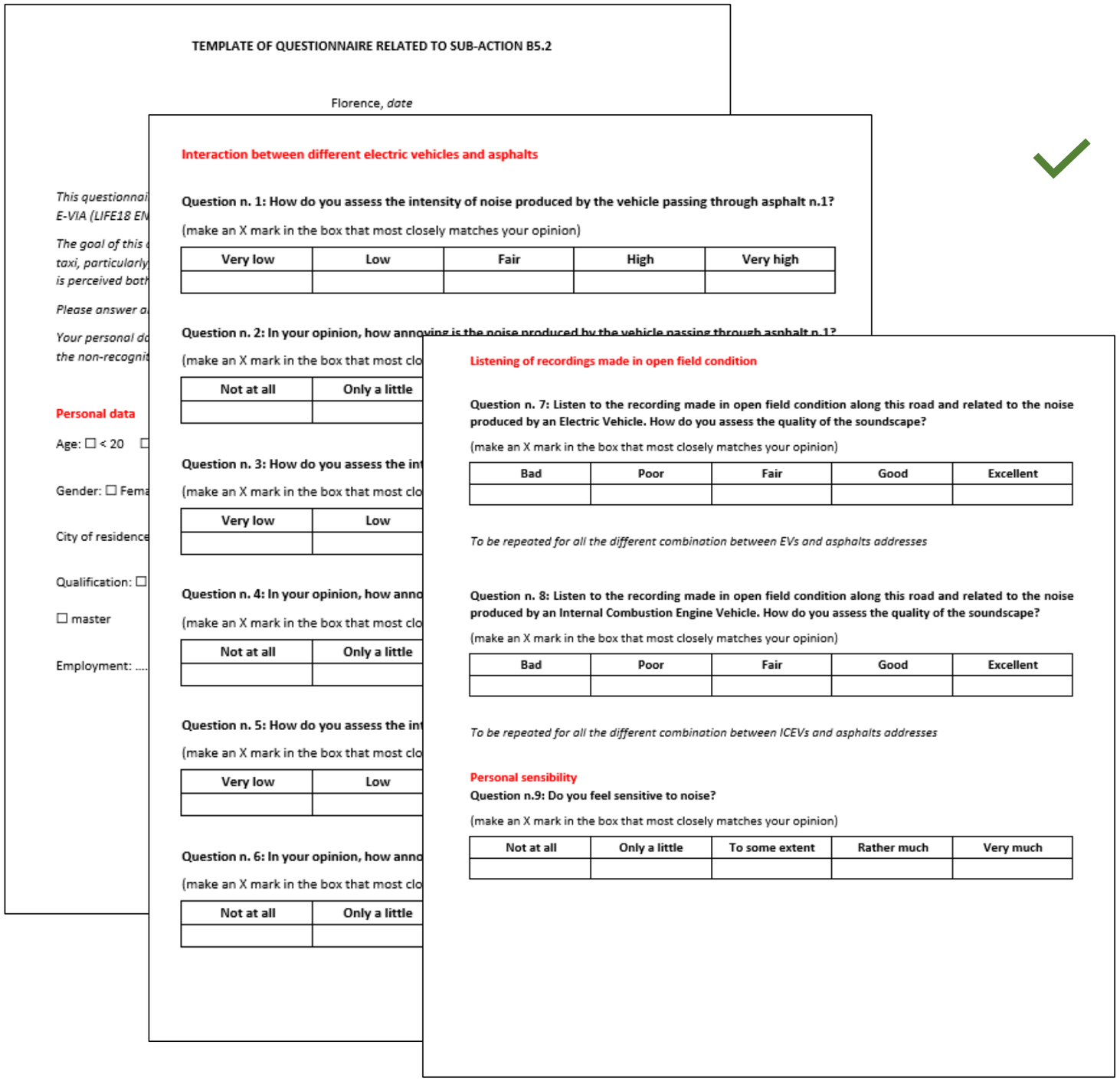
Steps:

1) Purchasing of instrumentation to carry out binaural recording and reproduction ✓
2) Recording of acoustic climate inside EV and ICE vehicles
3) Organization of soundwalks and recordings' reproduction ✓

Foreseen completion: March 2022

LIFE18 ENV/IT/000201
LIFE E-VIA PROJECT
25 February 2022 - Vie en.ro.se Ingegneria

B5.2 Interview in the pilot road on an electric taxi



TEMPLATE OF QUESTIONNAIRE RELATED TO SUB-ACTION B5.2

Florence, *date*

This questionnai
E-VIA (LIFE18 EN

The goal of this
taxi, particularly
is perceived both

Please answer a

Your personal da
the non-recogni

Personal data

Age: ☐ < 20 ☐

Gender: ☐ Fema

City of residence

Qualification: ☐

☐ master

Employment: ....

Interaction between different electric vehicles and asphalts

Question n. 1: How do you assess the intensity of noise produced by the vehicle passing through asphalt n.1?

(make an X mark in the box that most closely matches your opinion)

Very low	Low	Fair	High	Very high

Question n. 2: In your opinion, how annoying is the noise produced by the vehicle passing through asphalt n.1?

(make an X mark in the box that most clo

Not at all	Only a little

Question n. 3: How do you assess the int

(make an X mark in the box that most clo

Very low	Low

Question n. 4: In your opinion, how anno

(make an X mark in the box that most clo

Not at all	Only a little

Question n. 5: How do you assess the int

(make an X mark in the box that most clo

Very low	Low

Question n. 6: In your opinion, how anno

(make an X mark in the box that most clo

Not at all	Only a little

Listening of recordings made in open field condition

Question n. 7: Listen to the recording made in open field condition along this road and related to the noise produced by an Electric Vehicle. How do you assess the quality of the soundscape?

(make an X mark in the box that most closely matches your opinion)

Bad	Poor	Fair	Good	Excellent

To be repeated for all the different combination between EVs and asphalts addresses

Question n. 8: Listen to the recording made in open field condition along this road and related to the noise produced by an Internal Combustion Engine Vehicle. How do you assess the quality of the soundscape?

(make an X mark in the box that most closely matches your opinion)

Bad	Poor	Fair	Good	Excellent

To be repeated for all the different combination between ICEVs and asphalts addresses

Personal sensibility

Question n.9: Do you feel sensitive to noise?

(make an X mark in the box that most closely matches your opinion)

Not at all	Only a little	To some extent	Rather much	Very much

Steps:

✓ 1) Purchasing of instrumentation to carry out binaural recording and reproduction

2) Agreement with Taxy company

3) Organizations of surveys

Foreseen completion: March 2022

B5.3 Ante- and post-operam interviews with residents

COMUNE DI FIRENZE

DIREZIONE AMBIENTE
SERVIZIO Rifiuti, Igiene Pubblica, Ambientale e del Territorio

P.O. Igiene Pubblica, Ambientale e Vivibilità Urbana

Firenze, 2 luglio 2021

Oggetto: Avviso somministrazione questionario ai residenti di via Paisiello

Gentile cittadina/o,

il comune di Firenze è il capofila del progetto LIFE E-VIA (Electric Vehicle noIse control by Assessment and optimization of tyre/road interaction/Controllo del rumore dei veicoli elettrici mediante valutazione e ottimizzazione dell'interazione pneumatico/strada – www.life-evia.eu) co-finanziato dall'Unione Europea. Il progetto è iniziato nel 2019 e si concluderà ad inizio 2023.

Fra le azioni che verranno realizzate nel progetto, vi è la stesa di un asfalto ottimizzato per la riduzione del rumore in un'area pilota, individuata dal Comune in un tratto di Via Paisiello, compreso tra via Rinuccini e via Vivaldi. Tra i vari obiettivi del progetto vi è anche quello di sensibilizzare i cittadini sui temi dell'inquinamento acustico e sugli effetti sulla salute, spiegando le opportunità offerte dai veicoli elettrici attraverso eventi specifici di divulgazione e promozione e indagando anche sulla la percezione del rumore da parte delle persone, mediante l'utilizzo della metodologia di analisi del paesaggio sonoro.

A tal fine, un incaricato dal comune di Firenze e da Vie en.ro.se Ingegneria si presenterà presso il suo domicilio, nei giorni 6 e 7 luglio 2021 e le consegnerà un breve questionario da compilare al momento, fornendole qualche semplice istruzione. Per la compilazione saranno necessari al massimo 5 minuti. Il questionario sarà poi ritirato dallo stesso incaricato. Si precisa che l'incaricato non accederà alla sua abitazione, ma sosterà all'esterno e sarà dotato di tesserino di riconoscimento.

Il trattamento dei dati personali avverrà in modo riservato e la successiva pubblicazione dei risultati sarà realizzata con modalità tali da non consentire la riconducibilità delle risposte espresse alla persona intervistata.

La ringraziamo anticipatamente per la cortese e preziosa collaborazione.

Per ulteriori informazioni:

Ing. Chiara Bartalucci – 055 4379140

Dott.ssa Gessica Pecchioni – 055 2625360

Il Responsabile

Dr. Arnaldo Melloni – Direzione Ambiente comune di Firenze

A couple of days before the questionnaires' delivering, an informative letter has been provided to residents.

B5.3 Ante-operam interviews with residents

COMUNE DI FIRENZE

DIREZIONE AMBIENTE
SERVIZIO Rifiuti, Igiene Pubblica, Ambientale e del Territorio

P.O. Igiene Pubblica, Ambientale e Vivibilità Urbana

Firenze, 7 luglio 2021

Oggetto: Compilazione e ritiro questionario progetto LIFE E-VIA

Gentile cittadina/o,

come da comunicazione scritta ricevuta lo scorso 5 luglio, nell'ambito del progetto europeo LIFE E-VIA – www.life-evia.eu) coordinato dal comune di Firenze, è in corso un'indagine sulla percezione del rumore rivolta ai residenti di via Paisiello.

Alleghiamo alla presente il questionario che le chiediamo gentilmente di compilare. Le chiediamo, inoltre, di contattare l'incaricato dal comune di Firenze e da Vie en.ro.se Ingegneria (Ing. Chiara Bartalucci – Dott.ssa Giulia Iannuzzi, tel. 055 4379140, e-mail chiara.bartalucci@vienrose.it) per concordare il ritiro del questionario.

Nel caso in cui abbia già ricevuto il questionario nei giorni 6 e 7 luglio 2021 e lo abbia già compilato, le chiediamo, analogamente, di contattare l'incaricato dal comune di Firenze e da Vie en.ro.se Ingegneria (Ing. Chiara Bartalucci – Dott.ssa Giulia Iannuzzi, tel. 055 4379140, e-mail chiara.bartalucci@vienrose.it) per concordare il ritiro.

Ricordiamo che il trattamento dei dati personali avverrà in modo riservato e la successiva pubblicazione dei risultati sarà realizzata con modalità tali da non consentire la riconducibilità delle risposte espresse alla persona intervistata.

La ringraziamo anticipatamente per la cortese e preziosa collaborazione.

Per ulteriori informazioni:

Ing. Chiara Bartalucci – 055 4379140

Dott.ssa Gessica Pecchioni – 055 2625360

Il Responsabile

Dr. Arnaldo Melloni – Direzione Ambiente comune di Firenze

LIFE/ENV/IT000201 LIFE E-VIA

COMUNE DI FIRENZE Vie en.ro.se. Ingegneria

THE PROJECT

Exposure data from the European Environment Agency demonstrate that more than 100 million EU citizens are affected by high noise levels negatively impacting human health. Traffic noise alone is harmful to the health of almost every third person in the World Health Organization European Region. 20% of Europeans are regularly exposed to night sound levels that could significantly damage health, especially in urban areas. The introduction of electric mobility is widely viewed as having the potential to reduce noise in urban areas, but the noise generated by tyres rolling on the road nevertheless needs careful study and further reduction. As emerged in Noise in Europe Conference (April 2017) and in the WHO guidelines published in October 2018, the increased stringency of EU at source standards needs to be balanced against other effective measures such as road surface and/or tyre improvements and urban planning measures as well. One of the solutions universally recognized as the best to reduce noise in urban areas, from both the point of view of noise and air quality, is the introduction of electric mobility. Therefore, the project **LIFE E-VIA** (Electric Vehicle noise control by Assessment and optimization of tyre/road interaction– www.life-evia.eu) intends to: - tackle noise pollution from road traffic noise focusing on a future perspective in which electric and hybrid vehicles will be a consistent portion of flow; - combine knowledge of road optimization and tyre development in order to test an optimized solution for reducing noise in urban areas and Life Cycle Cost with respect to actual best practices . The Project LIFE E-VIA, co-financed by the European Union through the Life programme, started in July 2019 and will end in January 2023. Il Progetto, co-finanziato dall'Unione Europea attraverso il Programma LIFE, ha avuto inizio a luglio 2019 e terminerà a gennaio 2023. The project is coordinated by the Municipality of Florence and involves as partners the Mediterranean University of Reggio Calabria, Continental, Vie en.ro.se Ingegneria, University Gustave Eiffel and I-POOL.

THE SURVEY

The goal of this questionnaire is to collect data on the perception of the soudscape. In addition to some initial general questions, we kindly ask you to answer 10 questions related to the perception of the soundscape close to your home. Your personal data ***will be treated as strictly confidential and the publication of the survey results will ensure the non****-recognition of the responses. Please answer all questions in order, following the instructions provided.*

PERSONAL INFORMATION

I1. Age: ☐ 18-25 ☐ 26-40 ☐ 41-55 ☐ 56-65 ☐ 66-75 ☐ >75

I2. Gender: ☐ Female ☐ Male

I3. Education: ☐ Primary school ☐ Middle School ☐ High School ☐ Bachelor's Degree ☐ Ph.D. ☐ Master

I4. Occupation: _____

I5. City of Residence: _____

I6. Nationality: _____

D1. Does your home have windows overlooking via Paisiello? ☐ No ☐ Yes

D2. If so, which are the rooms that overlook via Paisiello?
(Make an X mark in the box for each room overlooking via Paisiello)

B5.3 Ante-operam interviews with residents

Room	*Overlooking via Paisiello*
Bedroom	☐
Single Bedroom	☐
Livingroom	☐
Kitchen	☐
Bathroom	☐
Other: ..... (Please specify)	☐

D3. How do you assess the intensity of the following four types of sound in the soundscape around you?
(make an X mark for each type of sound in the box that best matches your opinion)

Type of sound	*Very Low*	*Low*	*Fair*	*High*	*Very High*
Traffic (eg. Cars, motorcycles, clacson ...)	☐	☐	☐	☐	☐
Mechanical/electrical sounds (es. music, industries, sirens, constructions...)	☐	☐	☐	☐	☐
Anthropic sounds (es. voices, laughter, children, steps...)	☐	☐	☐	☐	☐
Nature sounds (es. wind, rustling leaves, birds ...)	☐	☐	☐	☐	☐

D4. How do you assess the quality of the soundscape around you?
(Please, tick the box that best matches your opinion)

0	1	2	3	4	5	6	7	8	9	10
Very Bad										***Excellent***

D5. Do you think the soundscape around you is appropriate for this place?
(Please, tick the box that best matches your opinion)

Absolutely inappropriate	0	1	2	3	4	5	6	7	8	9	10	***Completely appropriate***

D6. To what extent does it agree with the following statements about the sound environment around it??
(Please tick the box that best matches your opinion for each row)

The soundscape is:	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Enjoyable	☐	☐	☐	☐	☐
Chaotic	☐	☐	☐	☐	☐
Interesting	☐	☐	☐	☐	☐
Boring	☐	☐	☐	☐	☐
Relaxing	☐	☐	☐	☐	☐
Disturbing	☐	☐	☐	☐	☐
Lively	☐	☐	☐	☐	☐
Monotonous	☐	☐	☐	☐	☐

D7. How do you assess the quality of the urban landscape around you?
(Please tick the box that best matches your opinion)

Very Bad	0	1	2	3	4	5	6	7	8	9	10	***Excellent***

D8. Do you think that implementation of interventions for the reduction of noise could increase the value of your home?
(Please tick the box that best matches your opinion)

Not at all	0	1	2	3	4	5	6	7	8	9	10	***Surely***

D9. Do you think that your health can be affected by the reduction of noise levels close to your home?
(Please tick the box that best matches your opinion)

Not at all	0	1	2	3	4	5	6	7	8	9	10	***Surely***

D10. How do you assess your sensitivity to sounds?
(Please tick the box that best matches your opinion)

Very low	0	1	2	3	4	5	6	7	8	9	10	***Very High***

Informative letters and questionnaires have been delivered directly in the residents' mailbox and collected in the same way after compilation.

B5.3 Post-operam interviews with residents

COMUNE DI FIRENZE

DIREZIONE AMBIENTE
SERVIZIO Rifiuti, Igiene Pubblica, Ambientale e del Territorio

P.O. Igiene Pubblica, Ambientale e Vivibilità Urbana

Firenze, 20 settembre 2021

Oggetto: Compilazione e ritiro questionario post-operam progetto LIFE E-VIA

Gentile cittadina/o,

come da comunicazione scritta ricevuta lo scorso 5 luglio, nell'ambito del progetto europeo LIFE E-VIA – www.life-evia.eu) coordinato dal comune di Firenze, è in corso un'indagine sulla percezione del rumore rivolta ai residenti di via Paisiello.

In aggiunta al questionario da lei gentilmente compilato a luglio prima che venisse realizzata la stesa di un asfalto ottimizzato per la riduzione del rumore in un tratto di Via Paisiello, le chiediamo cortesemente di compilare un nuovo breve questionario che alleghiamo alla presente.

Per qualsiasi dubbio riguardo alla compilazione può contattare l'incaricato dal comune di Firenze e da Vie en.ro.se Ingegneria (Ing. Chiara Bartalucci e-mail chiara.bartalucci@vienrose.it – Dott.ssa Giulia Iannuzzi e-mail giulia.iannuzzi@vienrose.it, tel. 055 4379140).

Una volta compilato da lei ed eventualmente dai suoi familiari, le chiediamo gentilmente di lasciare i/il questionari/o nella cassetta delle lettere dell'impianto sportivo M. Pacini dell'A.S.D.L.F. Firenze Calcio, in via Paisiello 15r, entro il 28/09/2021.

Ricordiamo che il trattamento dei dati personali avverrà in modo riservato e la successiva pubblicazione dei risultati sarà realizzata con modalità tali da non consentire la riconducibilità delle risposte espresse alla persona intervistata.

La ringraziamo anticipatamente per la cortese e preziosa collaborazione.

Per ulteriori informazioni:

Ing. Chiara Bartalucci (Vie en.ro.se Ingegneria) – 055 4379140

Dott.ssa Gessica Pecchioni (Comune di Firenze) – 055 2625360

Il Responsabile

Dr. Arnaldo Melloni – Direzione Ambiente comune di Firenze

LIFE/ENV/IT000201 LIFE E-VIA
Progetto co-finanziato dalla Commissione Europea nell'ambito del Programma LIFE+2018.

COMUNE DI FIRENZE — Vie en.ro.se. Ingegneria

THE PROJECT

Exposure data from the European Environment Agency demonstrate that more than 100 million EU citizens are affected by high noise levels negatively impacting human health. Traffic noise alone is harmful to the health of almost every third person in the World Health Organization European Region. 20% of Europeans are regularly exposed to night sound levels that could significantly damage health, especially in urban areas. The introduction of electric mobility is widely viewed as having the potential to reduce noise in urban areas, but the noise generated by tyres rolling on the road nevertheless needs careful study and further reduction. As emerged in Noise in Europe Conference (April 2017) and in the WHO guidelines published in October 2018, the increased stringency of EU at source standards needs to be balanced against other effective measures such as road surface and/or tyre improvements and urban planning measures as well. One of the solutions universally recognized as the best to reduce noise in urban areas, from both the point of view of noise and air quality, is the introduction of electric mobility. Therefore, the project **LIFE E-VIA** (Electric Vehicle nolse control by Assessment and optimization of tyre/road interaction– www.life-evia.eu) intends to: - tackle noise pollution from road traffic noise focusing on a future perspective in which electric and hybrid vehicles will be a consistent portion of flow; - combine knowledge of road optimization and tyre development in order to test an optimized solution for reducing noise in urban areas and Life Cycle Cost with respect to actual best practices . The Project LIFE E-VIA, co-financed by the European Union through the Life programme, started in July 2019 and will end in January 2023. Il Progetto, co-finanziato dall'Unione Europea attraverso il Programma LIFE, ha avuto inizio a luglio 2019 e terminerà a gennaio 2023. The project is coordinated by the Municipality of Florence and involves as partners the Mediterranean University of Reggio Calabria, Continental, Vie en.ro.se Ingegneria, University Gustave Eiffel and I-POOL.

THE SURVEY

*The goal of this questionnaire is to collect data on the perception of the soudscape. In addition to some initial general questions, **we kindly ask you to answer 10 questions related to the perception of the soundscape close to your home. Your personal data** will be treated as strictly confidential and the publication of the survey results will ensure the non-recognition of the responses. Please answer all questions in order, following the instructions provided.*

PERSONAL INFORMATION

I1. Age: ☐ 18-25 ☐ 26-40 ☐ 41-55 ☐ 56-65 ☐ 66-75 ☐ >75

I2. Gender: ☐ Female ☐ Male

I3. Education: ☐ Primary school ☐ Middle School ☐ High School ☐ Bachelor's Degree ☐ Ph.D. ☐ Master

I4. Occupation: _____

I5. City of Residence: _____

I6. Nationality: _____

D1. Does your home have windows overlooking via Paisiello? ☐ No ☐ Yes

D2. If so, which are the rooms that overlook via Paisiello?
(Make an X mark in the box for each room overlooking via Paisiello)

B5.3 Post-operam interviews with residents

Room	*Overlooking via Paisiello*
Bedroom	☐
Single Bedroom	☐
Livingroom	☐
Kitchen	☐
Bathroom	☐
Other: ..... (Please specify)	☐

D3. How do you assess the intensity of the following four types of sound in the soundscape around you?
(make an X mark for each type of sound in the box that best matches your opinion)

Type of sound	*Very Low*	*Low*	*Fair*	*High*	*Very High*
Traffic (eg. Cars, motorcycles, clacson ...)	☐	☐	☐	☐	☐
Mechanical/electrical sounds (es. music, industries, sirens, constructions...)	☐	☐	☐	☐	☐
Anthropic sounds (es. voices, laughter, children, steps...)	☐	☐	☐	☐	☐
Nature sounds (es. wind, rustling leaves, birds ...)	☐	☐	☐	☐	☐

D4. How do you assess the quality of the soundscape around you?
(Please, tick the box that best matches your opinion)

0	1	2	3	4	5	6	7	8	9	10
Very Bad										***Excellent***

D5. Do you think the soundscape around you is appropriate for this place?
(Please, tick the box that best matches your opinion)

Absolutely inappropriate	0	1	2	3	4	5	6	7	8	9	10	***Completely appropriate***

D6. To what extent does it agree with the following statements about the sound environment around it??
(Please tick the box that best matches your opinion for each row)

The soundscape is:	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Enjoyable	☐	☐	☐	☐	☐
Chaotic	☐	☐	☐	☐	☐
Interesting	☐	☐	☐	☐	☐
Boring	☐	☐	☐	☐	☐
Relaxing	☐	☐	☐	☐	☐
Disturbing	☐	☐	☐	☐	☐
Lively	☐	☐	☐	☐	☐
Monotonous	☐	☐	☐	☐	☐

D7. How do you assess the quality of the urban landscape around you?
(Please tick the box that best matches your opinion)

Very Bad	0	1	2	3	4	5	6	7	8	9	10	***Excellent***

D8. To what extent has the noise of traffic you perceived changed in the past months?
(Please tick the box that best matches your opinion)

Increased					***Stable***	***Decreased***				
Very much		fairly		slightly		Slightly		Fairly		Very much
0	1	2	3	4	5	6	7	8	9	10

D9. How do you assess the effects of the re-paving of via Paisiello with the new asphalt on the traffic sound you perceive from your home?
(Please tick the box that best matches your opinion)

Negative					***Irrelevant***	***Positive***				
Very much		fairly		slightly		Poco		Abbastanza		Molto
0	1	2	3	4	5	6	7	8	9	10

D10. Do you think that the implementation of a low-noise asphalt has increased the value of your home?
(Please tick the box that best matches your opinion)

Not at all	0	1	2	3	4	5	6	7	8	9	10	***Surely***

D11. Do you think that your health can be improved by the recent reduction of noise levels close to your home?
(Please tick the box that best matches your opinion)

Not at all	0	1	2	3	4	5	6	7	8	9	10	***Surely***

D12. How do you assess your sensitivity to sounds?
(Please tick the box that best matches your opinion)

Very low	0	1	2	3	4	5	6	7	8	9	10	***Very High***

Collected questionnaires

Ante-operam		Post-operam	
Delivered	Filled	Delivered	Filled
92	56	101	56

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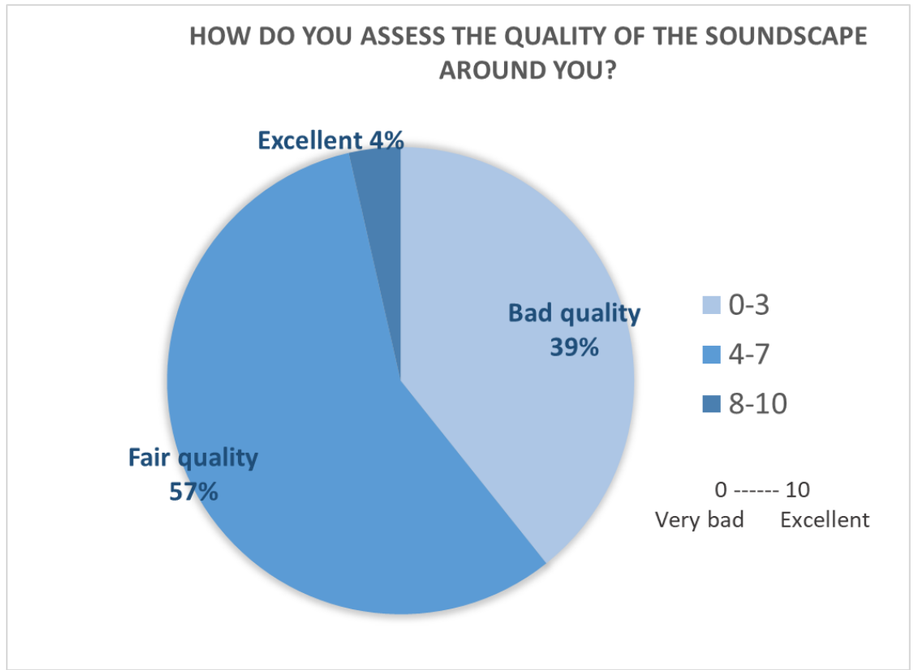
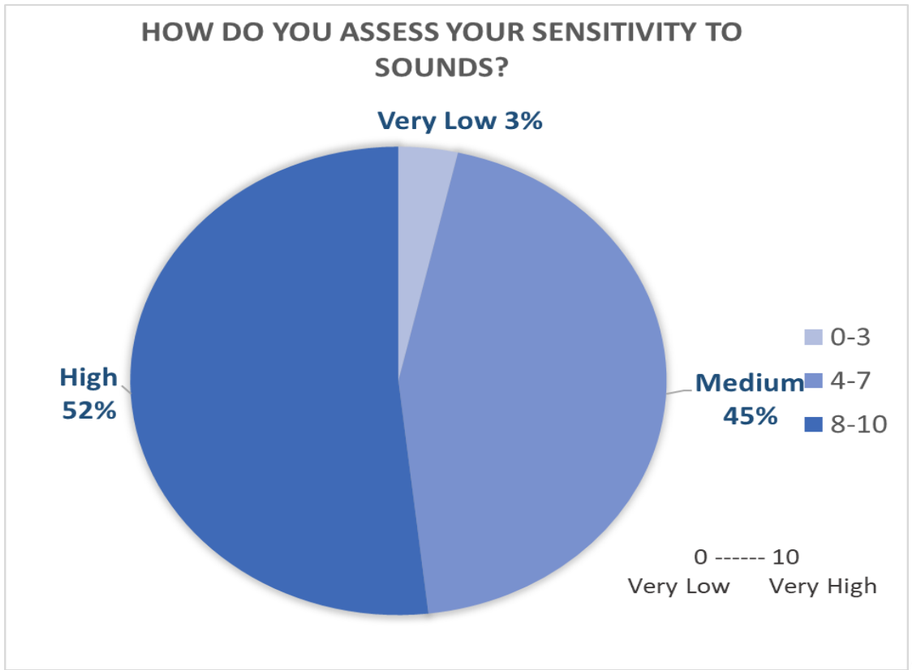
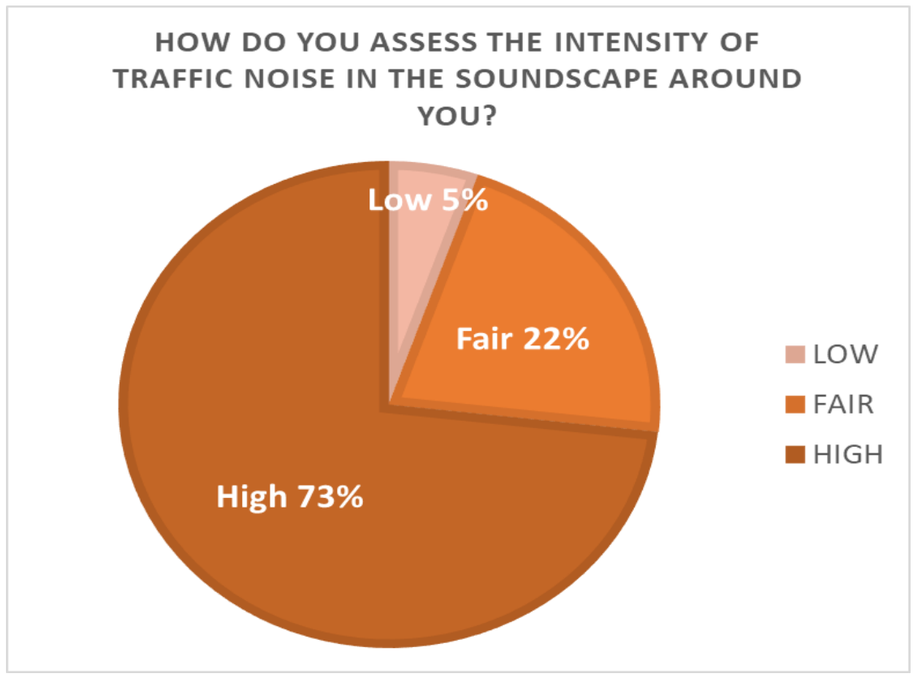
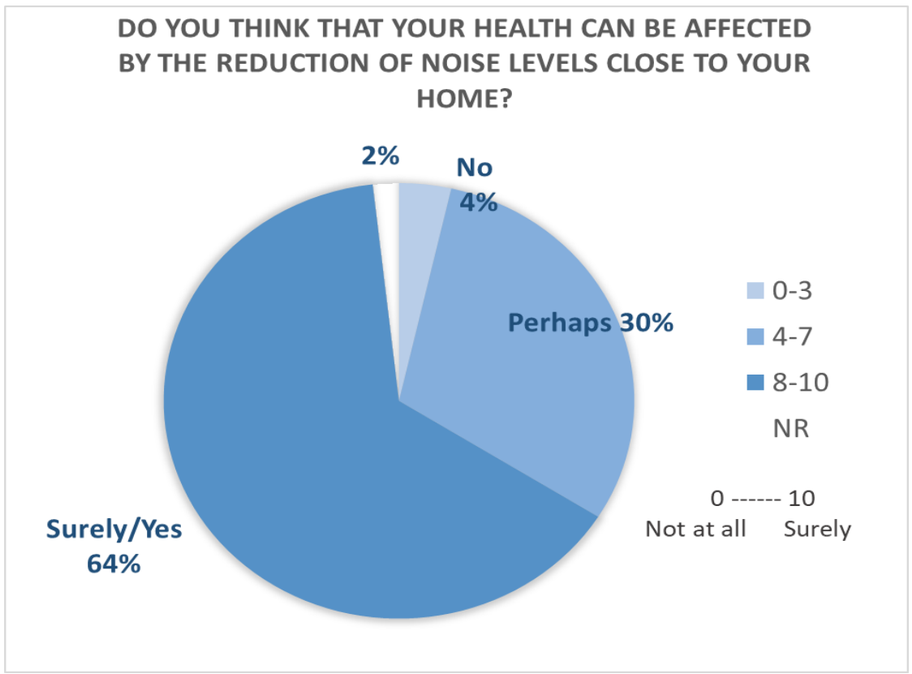
Ante-operam descriptive analysis

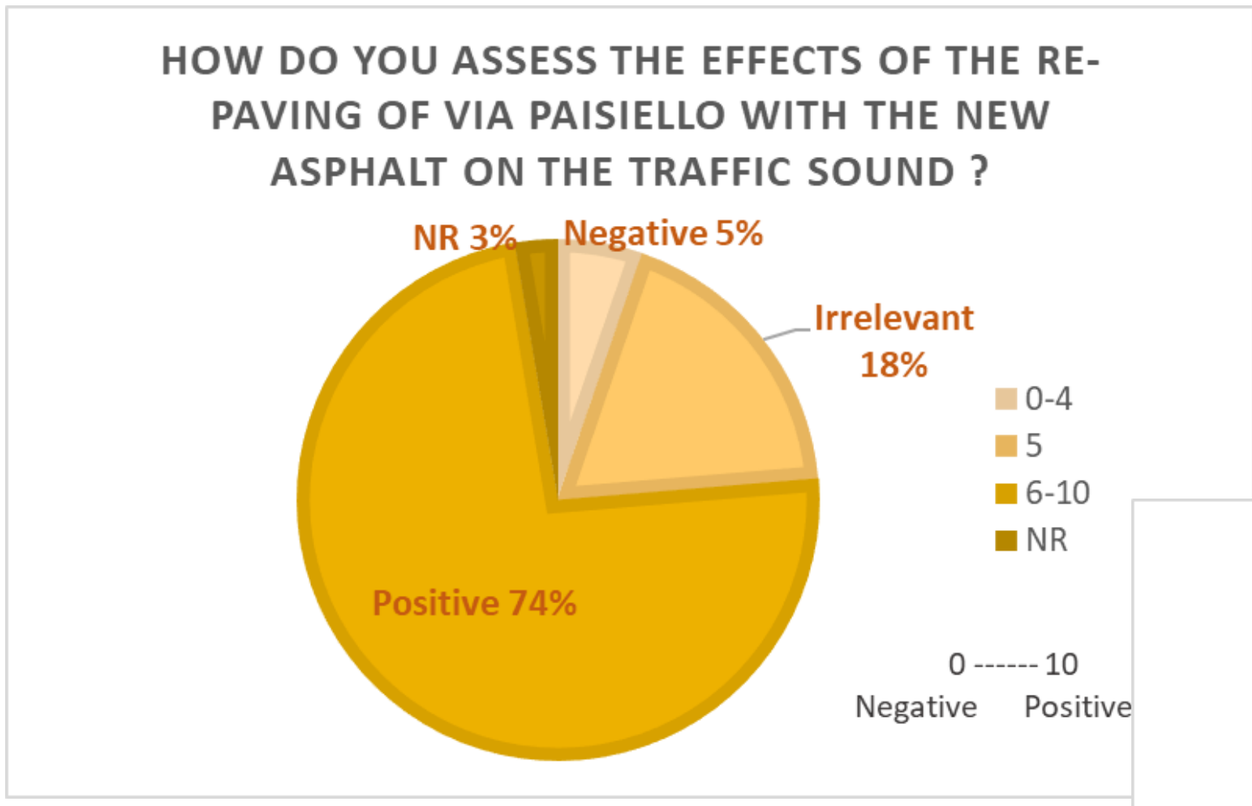


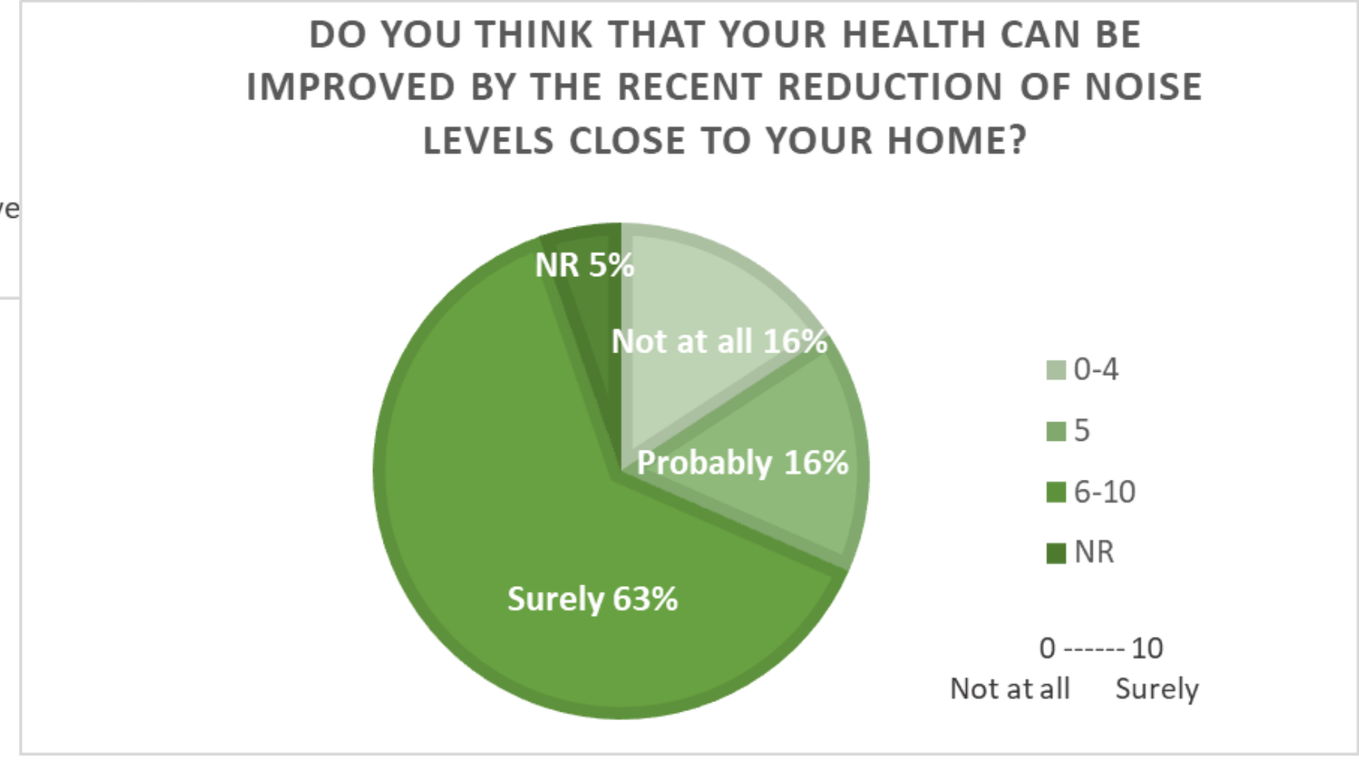




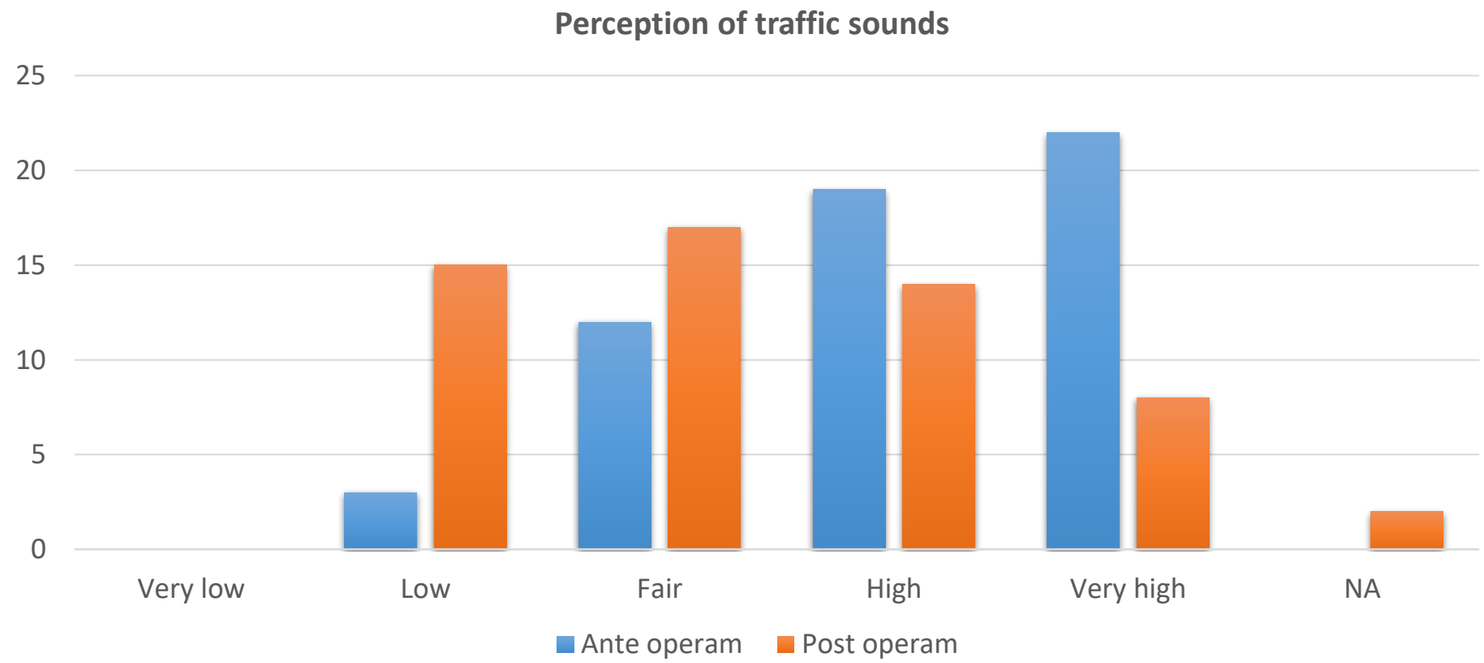


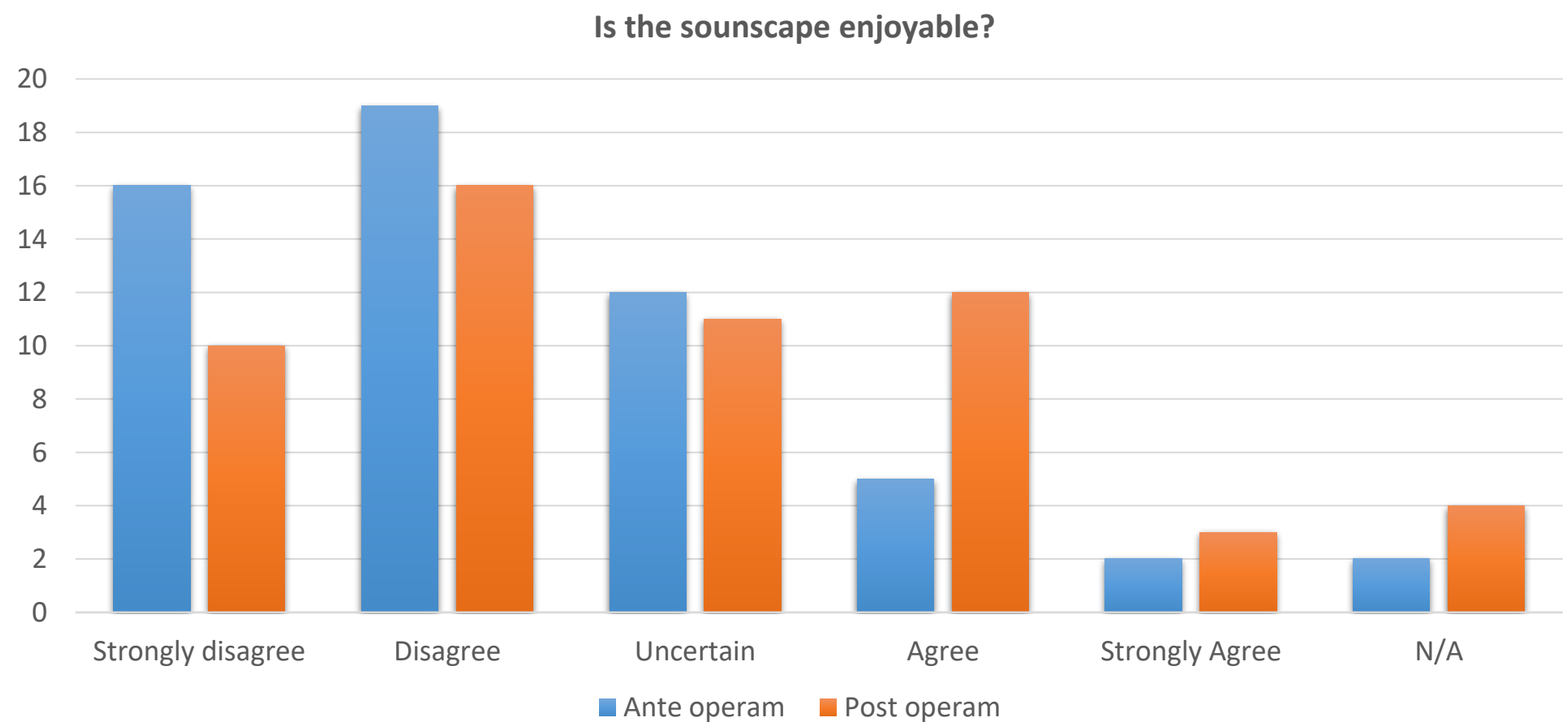
Post-operam descriptive analysis





Comparison between ante and post





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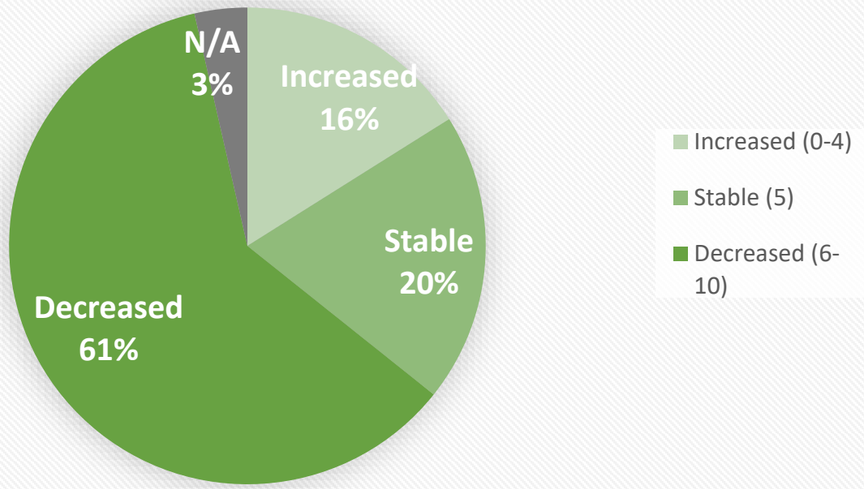
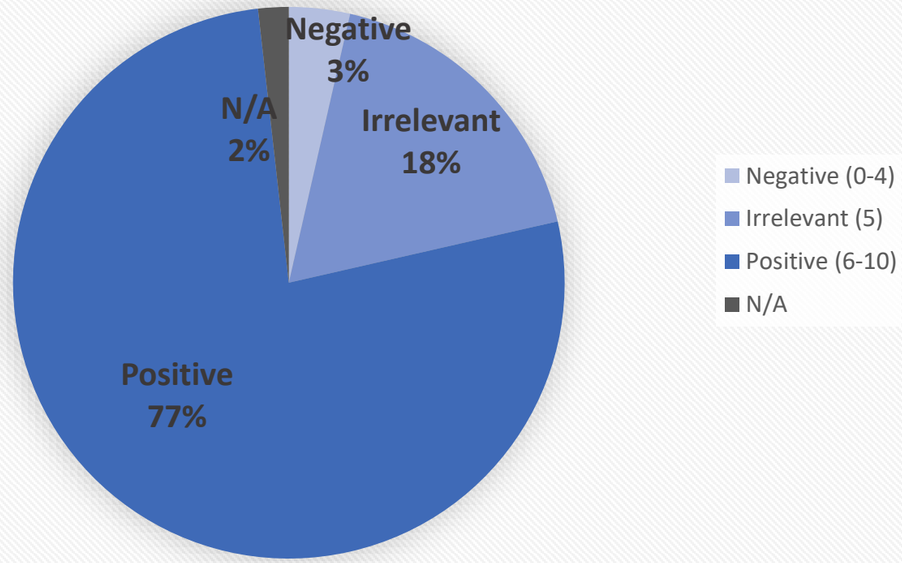
Comparison between ante and post

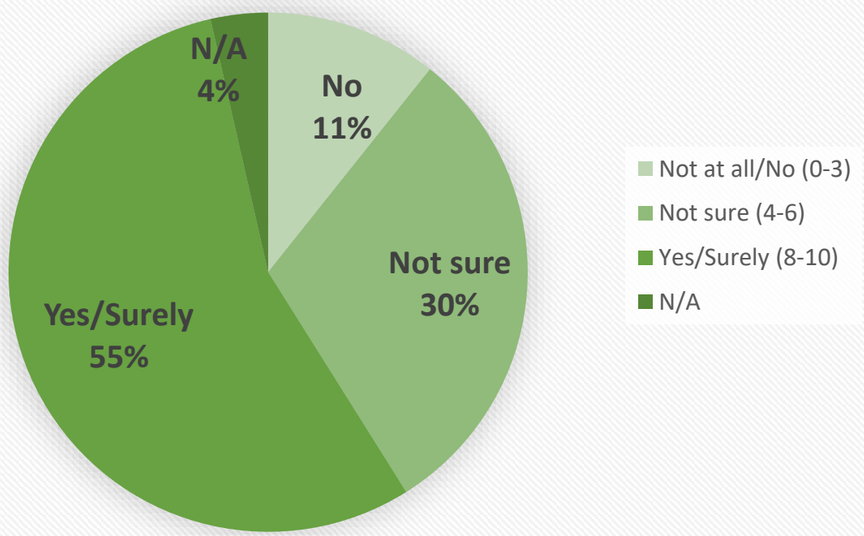
To what extent has the noise of traffic you perceived changed in the past months?



How do you assess the effects of the re-paving of via Paisiello with the new asphalt on the traffic sound ?



The implementation of a low-noise asphalt has increased the value of your home ?



Link between Pearson chi-square test and regression model

Variable		χ^2	DoF	p-value
Age		2.3173	5	0.8037
Gender		2.1455	3	0.5428
Education		4.3015	6	0.636
Occupation		7.3956	5	0.1928
Residency		1.1813	2	0.554
Nationality		2.1569	2	0.3401
Windows overlooking via Paisiello		2.7451	1*	0.09755
Rooms overlooking via Paisiello		1.2243	5	0.9425
Intensity of perceived sounds		0.63894	3	0.8875
Perception of traffic sounds		**18.153**	**4***	**0.001152**
Perception of technological sounds		8.4923	5	0.1311
Perception of anthropic sounds		4.1765	5	0.5243
Perception of natural sounds		3.7271	4*	0.4442
Soundscape quality		**11.889**	**3**	**0.007774**
Soundscape congruence		**10.5**	**3**	**0.01476**
Soundscape attributes		13.709	7	0.0566
Soundscape	Enjoyable	5.4343	5	0.3652
	Chaotic	4.8532	5	0.4341
	Interesting	1.7825	4*	0.7757
	Boring	5.547	5	0.3528
	Relaxing	6.1182	4*	0.1905
	Disturbing	**15.221**	**5**	**0.009457**
	Lively	3.2017	5	0.6689
	Monotonuous	5.3131	5	0.3789
Landscape quality		1.4815	3	0.6865
Sound sensitivity		2.5753	3	0.4618

Pearson chi-square test: some variables turn out to be significantly dependent on situation (ante/post).

To better analyze whether the re-pavement has brought improvements in terms of perception of sounds we use the variable "**soundscape quality**", which is "sensitive" on situation, as dependent variable in a regression model.

With the use of **regression models** we can establish if there are relationships between the response variable ("soundscape quality") and other covariates relating to perceptions of sounds or characteristics of the surrounding environment in the ante/post intervention periods.

Ordinal logit model

Firstly, we compare all the response values of the covariates and the response variable, between the two periods by creating original variables with a value of 0 if the value has decreased; 1 if it has remained unchanged and 2 if it has increased.

Given the nature of the variables created, we choose to use an **ordinal logit model**.

An ordered logit model for an ordinal response Y_i with C categories is defined by a set of C-1 equations where the cumulative probabilities are related to a linear predictor $\beta' x_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots$ through the logit function:

$$logit(g_{ci}) = \log\left(\frac{g_{ci}}{1 - g_{ci}}\right) = \alpha_c - \boldsymbol{\beta}' \boldsymbol{x}_i$$

The parameters α_c, called thresholds or cutpoints, are in increasing order ($\alpha_1 < \alpha_2 < \ldots < \alpha_{C-1}$).

Model

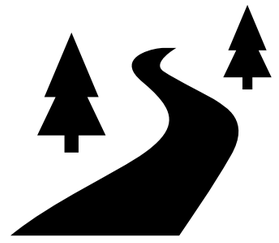
$$logit("soundscape\ quality"_{ci}) = \alpha_c - (\beta_1 * traffic\_sounds + \beta_2 * interesting\_soundscape + \beta_3 * nature\_sounds + \beta_4 * relaxing\_soundscape + \beta_5 * sensitivity\_sounds$$

qual_amb	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
traffico						
Unchanged	-7.047367	2.399337	-2.94	0.003	-11.74998	-2.344753
Yes	-8.004159	3.208891	-2.49	0.013	-14.29347	-1.714848
interessante						
Unchanged	5.320089	2.049402	2.60	0.009	1.303335	9.336843
Yes	1.914986	1.556173	1.23	0.218	-1.135057	4.96503
natura						
Unchanged	-.6013872	1.685393	-0.36	0.721	-3.904697	2.701922
Yes	9.055464	3.111493	2.91	0.004	2.957049	15.15388
rilassante						
Unchanged	4.754028	2.527349	1.88	0.060	-.1994857	9.707541
Yes	3.73245	2.311063	1.62	0.106	-.7971497	8.262049
sensibilita						
Unchanged	4.547256	2.190113	2.08	0.038	.2547141	8.839798
Yes	1.598098	1.349631	1.18	0.236	-1.047129	4.243325
/cut1	3.365244	2.201415			-.9494507	7.679939
/cut2	6.073346	2.42071			1.328842	10.81785

Results

- For the **traffic sounds** variable who did not vary the response between the two periods or who responded that they heard **less traffic in the post-intervention** period tended to give a **higher score on the soundscape quality** than those who found a worsening in the traffic perception.

- Instead for the **nature sounds** the model shows that who hear **more the sounds of nature in the post-intervention** period than those who hear them less tend to perceive a **better soundscape quality**.



- Looking at the characteristics of the "interesting" and "relaxing" environment we note that in the first case those who find the **environment interesting in the same way** in the two periods compared to those who find it less interesting tend to perceive a **better soundscape quality**. While for the "relaxing" characteristic, those who find the **relaxing environment in the same way or more relaxing in the second period** compared to who find the environment less relaxing tend to perceive a **higher soundscape quality**.

- Finally, those who responded that they were **sensitive to the environment in the same way** tend to perceive a **better soundscape quality** than those who were less sensitive in the second period.

Report on Action B5

A SURVEY TO EVALUATE RESIDENTS' SOUNDSCAPE PERCEPTION BEFORE AND AFTER THE IMPLEMENTATION OF LOW-NOISE ASPHALT IN THE PILOT CASE

Index

1. Introduction: the pilot case in Florence .....
2. Survey design .....
2.1 Ante operam questionnaires: design and distribution .....
2.2 Post operam questionnaires: design and distribution .....
3. Results .....
3.1 Descriptive analysis .....
3.1.1 Ante operam results .....
3.1.2 Post operam results .....
3.1.3 Comparative analysis .....
3.2 Statistical analysis .....
4. Conclusions .....

In progress

Ante and post-operam noise measurements campaign - introduction

Although not foreseen in the original project proposal, in order to obtain an objective basis for the citizens evaluation at a façade level to be carried out in Action B5, a **long-term** (2 weeks) ante and post- noise monitoring campaign has been carried out by VIENROSE and I-POOL.

LIFE E-VIA asphalt

Standard asphalt

Ante and post-operam noise measurements campaign - introduction

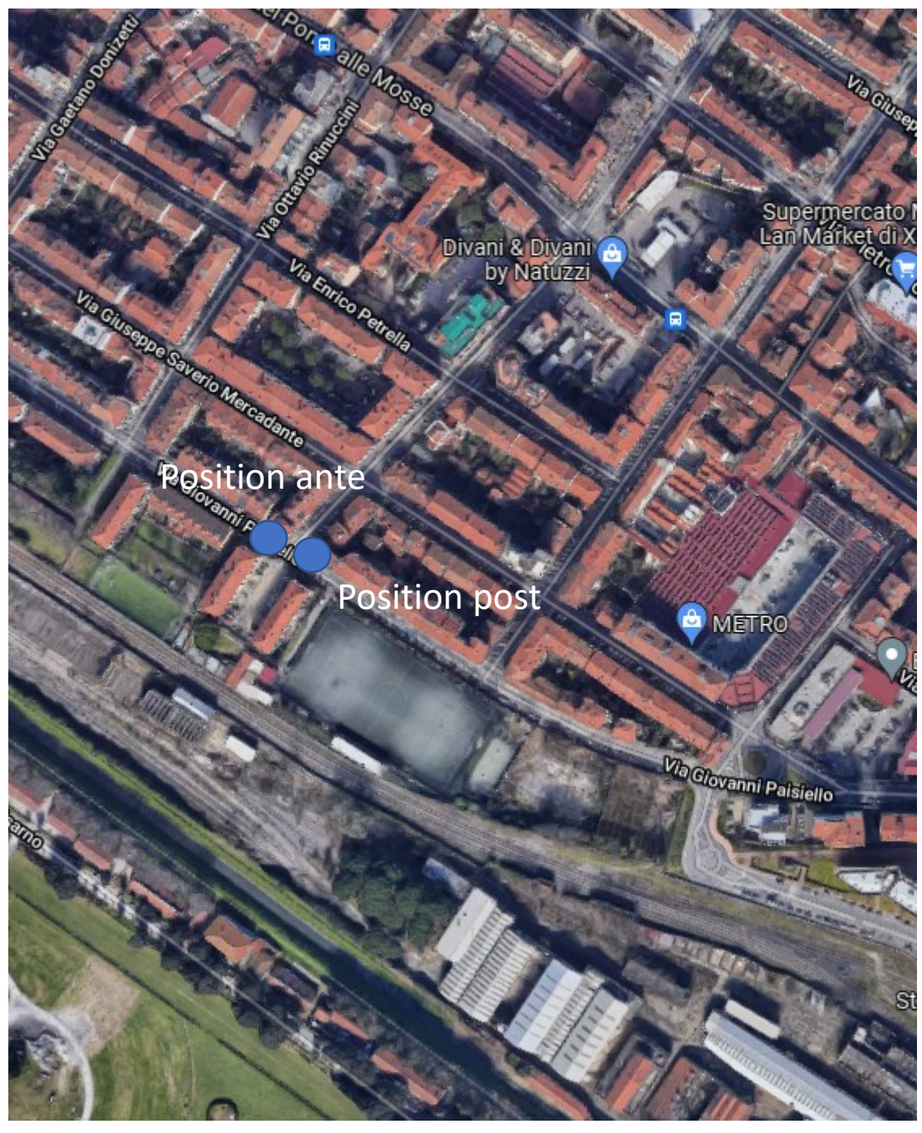
2 monitoring positions have been defined: one in the road section interested by the LIFE E-VIA asphalt (150 m) and the other in the road section interested by a new standard asphalt (150 m).

Ante-operam campaign carried out by VIENROSE
Period: 23rd June – 1st July 2021

Post-operam campaign carried out by I-POOL
Period: 17th – 28th September 2021

Ante and post-operam noise measurements campaign – traffic measures

A **traffic counter** has been positioned on light poles both in the ante and post-operam phase in similar positions, in order to be able **to weight measured noise levels according to traffic flows in different periods**.



Ante and post-operam noise measurements campaign – data analysis

For the two periods: rainy days have been excluded and 4 weekdays have been considered for the comparison; weight according to different traffic flows have been applied.

LIFE E-VIA asphalt		
	Lden	Lnight
Leq (ante-post)	3,4	4,4

New but standard asphalt		
	Lden	Lnight
Leq (ante-post)	0,2	1,5

LIFE E-VIA

Electric **V**ehicle no**I**se control by **A**ssessment and optimisation of tyre/ road interaction

www.life-evia.eu

LIFE E-VIA PROJECT

Monitoring visit 25TH February 2022 - Firenze

Vienrose Ingegneria

Responsible for actions B5, D1 and D2

Raffaella Bellomini, Sergio Luzzi, **Chiara Bartalucci**, Sara Delle Macchie, Lucia Busa, **Francesco Borchi**, Gianfrancesco Colucci

With the contribution of the LIFE programme of the European Union

LIFE18 ENV/IT/000201

LIFE E-VIA

Electric **V**ehicle no**I**se control by **A**ssessment and optimisation of tyre/ road interaction

www.life-evia.eu

Start : July 1st, 2019

End: March 31st, 2023

LIFE E-VIA PROJECT – MONITORING VISIT FEBRUARY 25th, 2022

Università degli Studi 'MEDITERRANEA' di Reggio Calabria

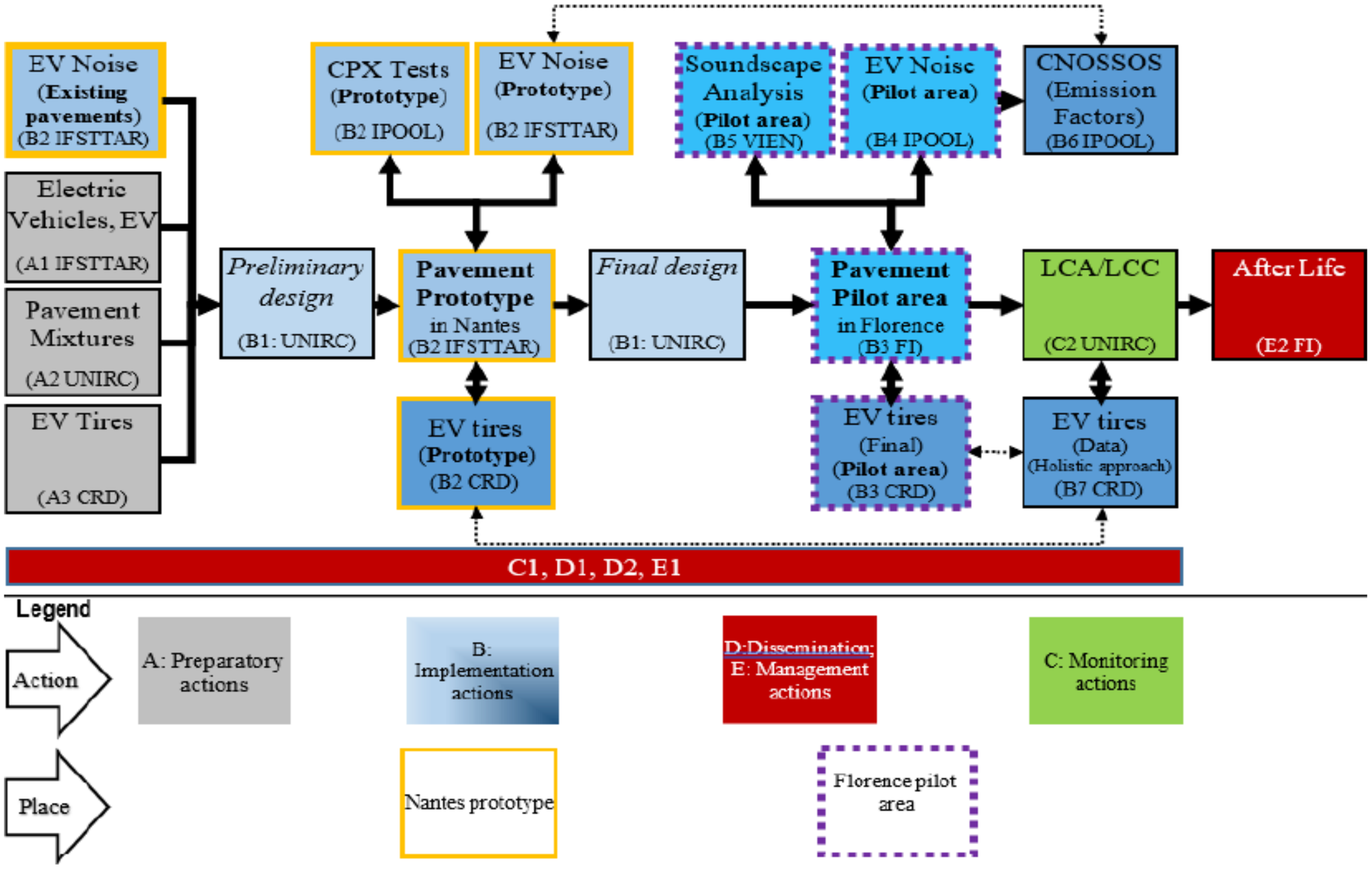
With the contribution of the LIFE programme of the European Union

LIFE18 ENV/IT/000201

1/40. Overall: Gantt chart

Action		2019				2020				2021				2022				2023				2024			
Action numbe	Name of the action	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
A. Preparatory actions (if needed)																									
A.1	Electric vehicles and their noise emission IFSTTAR			■	■	■																			
A.2	Quiet pavement technologies and their performance over time UNIRC			■	■	■																			
A.3	Tyre role in the new context of EV and ICEV CRD			■	■	■																			
B. Implementation actions (obligatory)																									
B.1	Tracks design UNIRC				■	■	■	■	■	■															
B.2	Tyre-pavement coupling study and prototype implementation IFSTTAR			■	■	■	■	■	■	■	■	■													
B.3	Pilot area: Implementation. FI						■	■	■	■	■	■	■	■	■	■	■	■							
B.4	Track efficiency tests in the pilot area IPOOL							■	■	■	■	■	■	■	■	■									
B.5	Soundscape analysis VIENROSE			■	■	■	■	■	■	■	■	■	■	■											
B.6	Evaluation of EV noise emissions IPOOL							■	■	■	■	■	■	■	■	■									
B.7	Holistic performances of tyres CRD			■	■	■	■	■	■	■	■	■	■	■	■	■	■								
B.8	Replicability and Transferability FI							■	■	■	■	■	■	■	■	■	■								
C. Monitoring of the impact of the project actions (obligatory)																									
C.1	Monitoring of the impact of the project actions FI			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							
C.2	Life cycle analysis (LCA) and life cycle costing (LCC) UNIRC			■	■	■	■	■	■	■	■	■	■	■	■	■	■								
D. Public awareness and dissemination of results (obligatory)																									
D.1	Information and awareness raising activities VIENROSE			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							
D.2	Technical dissemination activities to stakeholders VIENROSE			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■							
E. Project management (obligatory)																									
E.1	Coordination, Monitoring and Project management FI			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						
E.2	After LIFE Plan FI																■	■							

2/40. Overall: Flowchart



3/40. Overall: Actions of the project in which UNIRC is involved

- ☑ **A.1 Electric vehicles and their noise emission (scheduled: 07/2019-03/2020, [IFSTTAR]) - COMPLETED**
- ☑ **A.2 Quiet pavement technologies and their performance over time (scheduled: 07/2019-03/2020, [UNIRC]) - COMPLETED**
- ☑ **B.1 Tracks design (scheduled: 10/2019-03/2021, [UNIRC]) - COMPLETED**
- ☑ **B.2 Tyre-pavement coupling study and prototype implementation (scheduled: 07/2019-09/2021, [IFSTTAR]) - COMPLETED**
- ❑ B.3 Pilot area: Implementation (scheduled: 04/2020-03/2023, [FI])
- ❑ B.8 Replicability and Transferability (scheduled: 07/2020-12/2022, [FI])
- ❑ C.1 Monitoring of the impact of the project actions (scheduled: 07/2019-03/2023, [FI])
- ❑ C.2 Life cycle analysis (LCA) and life cycle costing (LCC) (scheduled 07/2019-03/2023, [UNIRC])
- ❑ D.1 Information and awareness raising activities (scheduled: 07/2019-03/2023, [VIENROSE])
- ❑ D.2 Technical dissemination activities to stakeholders (scheduled: 07/2019-03/2023, [VIENROSE])
- ❑ E.1 Coordination, Monitoring and Project management (scheduled: 07/2019-03/2023, [FI])

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4/40. Overall: Objectives in practice

Experiments
2 pavement solutions
5 different EV types
One reference ICE vehicle
3*6=18 types of tyres

Analyses
LCA and LCCA
CNOSSOS-EU coefficients

Results
low-noise, durable, and sustainable surfaces.
National and Italian regional policies.
Raise people's awareness

In practice
Reducing noise emission by 5 dB(A).
CO2 emissions reduction (21%).

5/40. Focus on A2

Action A2

Quiet pavement technologies and their performance over time [scheduled: 07/2019-03/2020]

COMPLETED

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6/40. Focus on A2: Pavement solutions in the literature

A careful study of pavement solutions (including crumb-rubber solutions) in the literature was carried out. The acoustic durability of different types of bituminous mixtures was considered. Clogging phenomena resulted crucial for diminished acoustic performance, especially when dealing with open-graded friction courses.

The following table, reported as an example, summarises some of more than 150 pavement solutions considered in the literature. When available, the acoustic performance was reported. Note that the following pieces of information are reported: 1) Reference (REF). 2) Solution (type of solution). 3) Thickness (mm). 4) Maximum aggregate size (MAS) or Nominal Maximum aggregate size (NMAS), mm. 5) Macrotexture (MTD, mm) or/and air void content (AV, %). 6) Acoustic indicator used (AC). 7) Noise reduction (RED, dB). 8) Acoustic durability (ACDUR, years). 9) Noise increase NI (dB/year).

7/40. Focus on A2: Pavement solutions in the literature

Reference	Type of solutions	Thickness (mm)	Maximum aggregate size or NMAS (mm)	Texture (mm) or/and air void content (%)	Acoustic indicator used	Noise reduction (dB)	Noise increase (dB/year)
(Donavan and Janello, 2018)	ARFC	25 mm	9.5 mm	20-21%	CPX/OBSI	/	0.5 dB/Year
(Anderson et al., 2013; Pierce et al., 2009)	OGFC-AR	19 mm	9.51 mm		OBSI	4.3 (vs. HMA)	2.1
	OGFC-SBS	19 mm	9.51 mm		OBSI	3.4 (vs. HMA)	1.45
	HMA	30 mm	12.5 mm		OBSI	/	1.03
(Bendtsen et al., 2010, 2009; Illingworth et Rodkin, 2002)	OGAC	25 mm	9.5 mm	/	/	/	0.11-0.19
(Bendtsen et al., 2010, 2009; Rochat et al., 2010)	DGAC	30 mm	12.5 mm	9%	SPB	/	0.24*-0.29**
	OGAC	30 mm	12.5 mm	15%	SPB	1.7 (vs. DGAC)	0.20*-0.12**
	OGAC	75 mm	12.5 mm	12%	SPB	3.3 (vs. DGAC)	0.10*-0.31**
	RAC-O	30 mm	12.5 mm	12%	SPB	2.3 (vs. DGAC)	0.40*-0.36**
	BWC	30 mm	12.5 mm	7%	SPB	0.9 (vs. DGAC)	/
(Bendtsen and Nielsen, 2008)	DGAC11	33 mm	11	2.8	SPB/CPX	/	0.72*-0.8**
	UTLAC	22 mm	8	14.4	SPB/CPX	2.2 (vs. DGAC11)	1.06*-0.35**
	OGAC	28 mm	8	15.3	SPB/CPX	2.9 (vs. DGAC11)	0.8*-0.09**
	SMA8	29 mm	8	12.4	SPB/CPX	0.4 (vs. DGAC11)	0.5*-0.21**
	SMA6+	26 mm	6+5/8	3.0	SPB/CPX	1.6 (vs. DGAC11)	0.93*-0.63**
	SMA8+	33 mm	8+8/11	5.7	SPB/CPX	2.5 (vs. DGAC11)	1.32*-0.67**

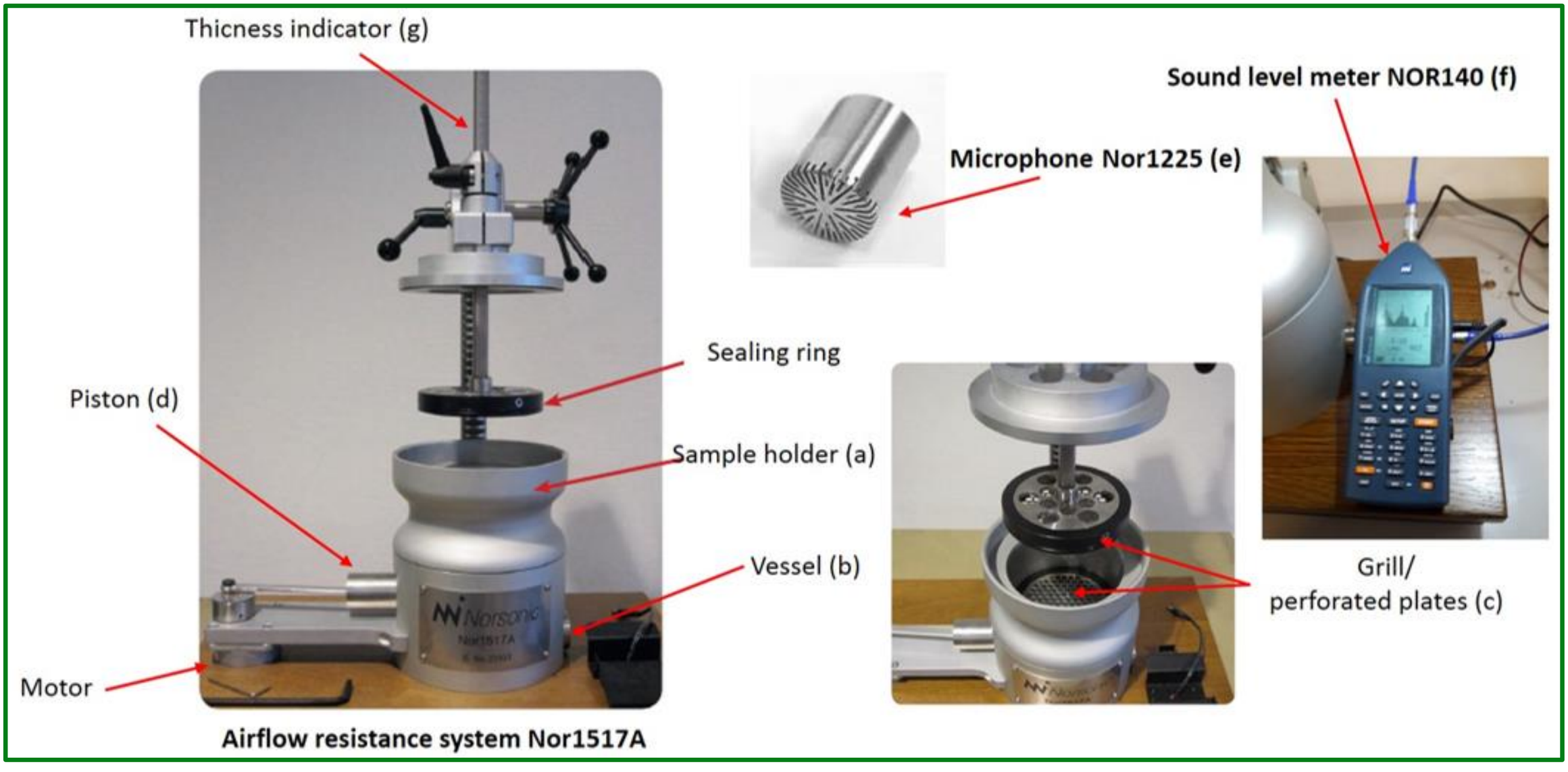
8/40. Focus on A2: Preliminary tests

It is noted that through this project a device (see figure) was bought to carry out airflow resistance measurements. The airflow resistance is the resistance of an air particle passing through a material. It can be expressed as the ratio of the pressure gradient in a material to the airflow linear velocity (L. Peng).

The airflow resistance was measured using the apparatus Norsonic Nor1517A, by applying the alternating airflow method (Method B) in accordance to UNI EN ISO 9053-1:2019.

Airflow resistance system Nor1517A

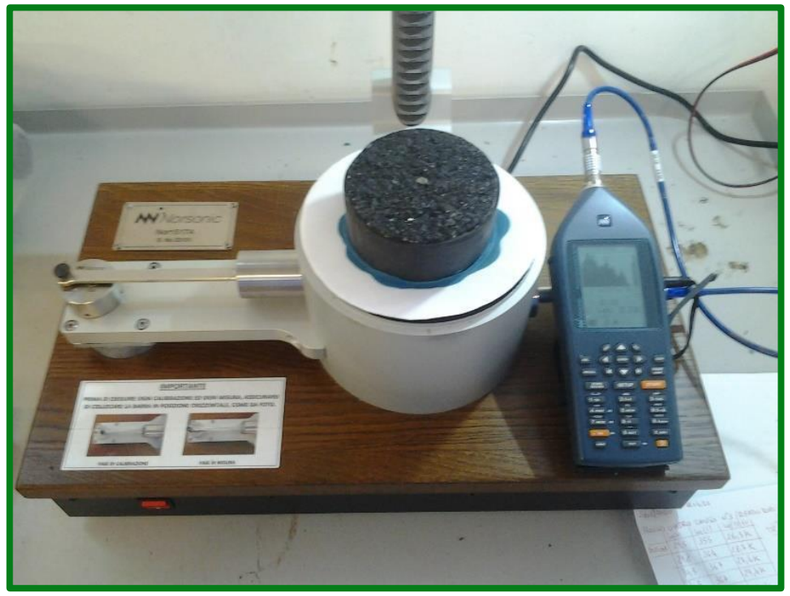
9/40. Focus on A2: Preliminary tests



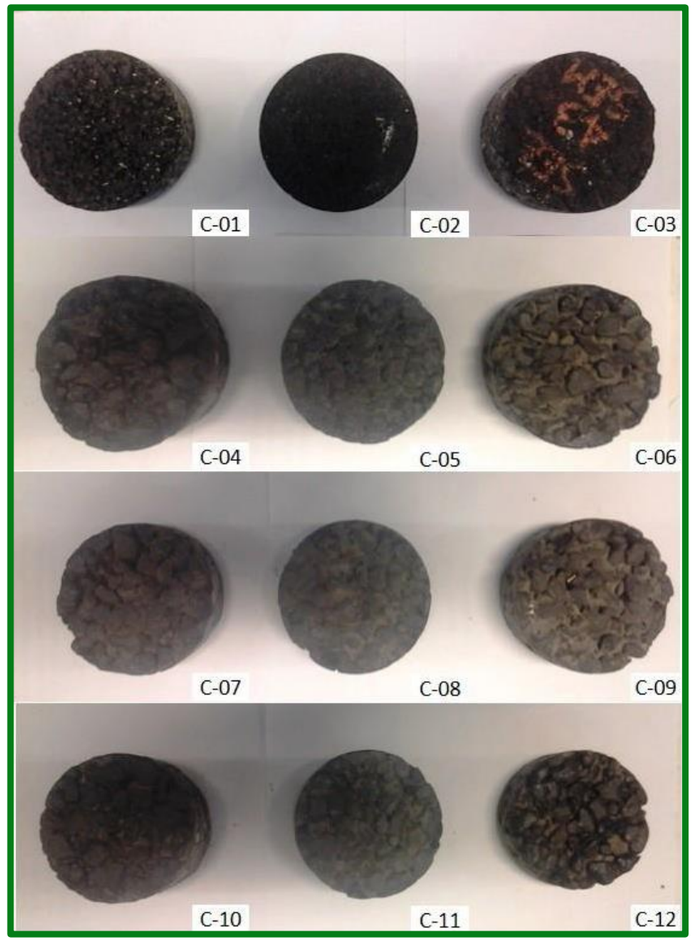
Airflow resistance system Nor1517A

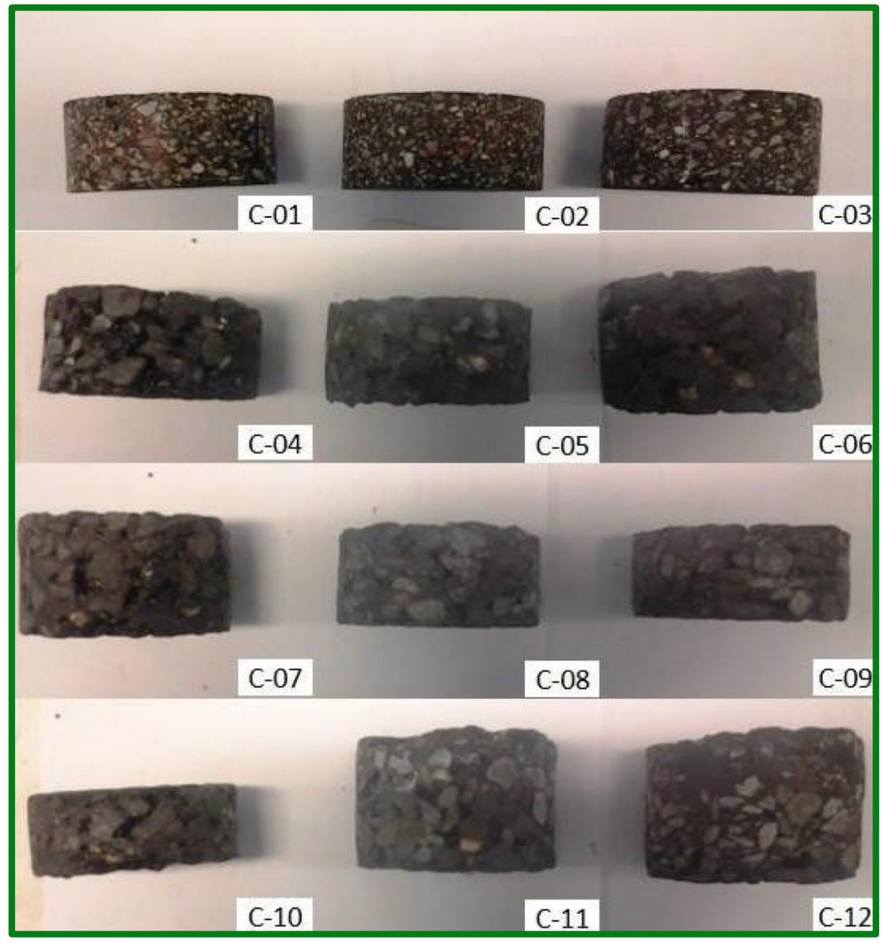
10/40. Focus on A2: Preliminary tests

A validation phase involved a series of tests performed on twelve cylindrical cores of two types of bituminous mixtures. Three specimens (C-01, C-02, and C-03) were dense graded (DG), while the others (C-04 to C-12) were open graded (OG). Each specimen was tested five times on both sides (top and bottom). Each measurement lasted 10 seconds.



Specimen positioning on test apparatus





Specimens used for the preliminary experiments

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11/40. Focus on A2: Selected mixes

To select the mixes, UNIRC analysed more than 150 solutions in literature (pavement, bituminous mixtures), based on acoustic and non-acoustic performances. Their characteristics and impacts were considered. Preliminary tests were carried out. In more detail, the following characteristics and parameters have been taken into account:

- Acoustic response (as-built and over time)
- Expected life by referring to mechanistic properties
- Permeability
- Friction

The following main criteria were followed to select the mixtures:

- **Having a satisfactory expected life**
- **Having an ENDt (Estimated Noise Difference Due to Texture) value sufficiently low**
- **Having satisfactory characteristics for the remaining properties**

Based on the above, the 9 mixtures reported in the table were selected.

	Acronym	END_t (dB)	MPD (mm)	AV (%)	BPN
1	AC6	0.7	0.72	11.7	≥60
3	SUP	1.2	0.92	8.2	≥60
4	OG4	2.9	1.79	17.4	≥55
6	GAP	0.7	0.95	6.9	≥55
10	SM6	1.7	0.8	7.6	≥60
11	SM6*	2.4	1.04	3.7	≥60
12	AC6*	2.2	1.1	7.4	≥60
13	SM8	1.7	0.9	7.3	≥60
19	ISO	0	0.5	4	≥60

12/40. Focus on B1 - Track design – [scheduled: 10/2019-03/2021]

COMPLETED

Main sub actions/milestones/deliverables	Main internal/draft Documents
Sub-action B1.1 - Data gathering	
Sub-action B1.2 - Preliminary design of the mixture	Report_B1_LIFE_UNIRC_excerpt draft July 28; for Julien August 27 2020 B1 life
Sub-action B1.3 - Data gathering from IFSTTAR that refer to Nantes prototype	D44.20.REZE.056 - Université EIFFEL - piste référence 2020 09 08 - suivi BBTM6 poudrette; D44.20.REZE.056 - Université EIFFEL - piste référence 2020 09 08 - suivi BBTM6; LIFE E-VIA_202103151_B2_action_UGE_Cesbron_OneDrive_internal_version
Sub-action B1.4 - Data gathering from IFSTTAR that refer to IPOOL tests	Carried out
Sub-action B1.5 - Final design and support to track construction	Report_B1_LIFE_UNIRC_26_11_2020_F; Life E-Via B1 for B3 27 04 2021
Milestone name B1 Tracks design. Deadline: [01/2021]	**Carried out**
Deliverable name: B1 Report. **Deadline** [03/2021]	Draft Based on Report_B1_LIFE_UNIRC_26_11_2020_F +Life E-Via B1 for B3 27 04 2021 +for Julien August 27 2020 B1 life

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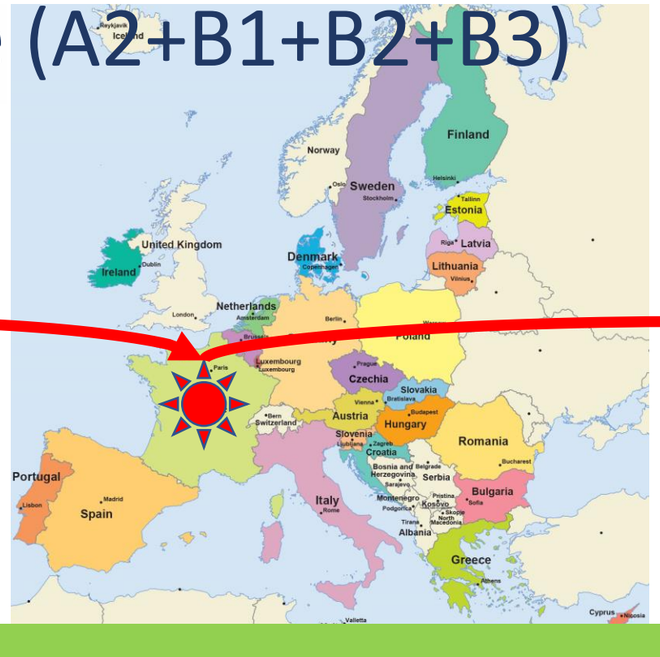
13/40. Towards Florence (A2+B1+B2+B3)



A2- Pavement mixtures (UNIRC)

From more than 150 to 9 mixtures

B1.2- Preliminary design (UNIRC)

9 mixtures

B1.3, B1.4 - Data from IFSTTAR/ IPOOL to UNIRC

B2- Pavement prototype (IFSTTAR)

2mixtures 0/6 (with or without CR)

B1.5- Final design (UNIRC)

1 traditional mixture + 1 CR-added mixture

B3- Pilot area (FI)

1 traditional mixture + 1 CR-added mixture

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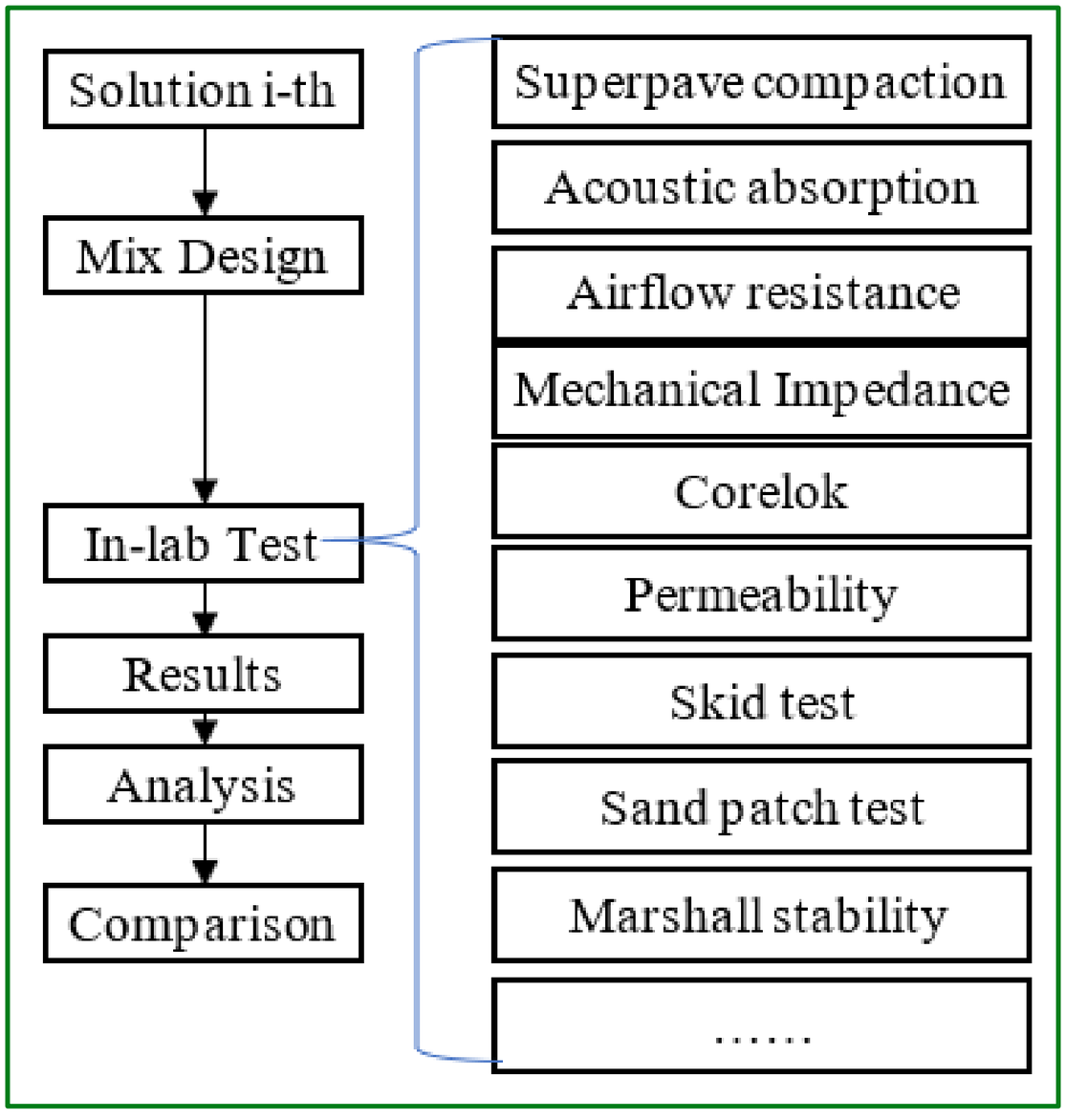
14/40. Focus on B1.1- B1.2- B1.5

The Aim of the action B1 was to select mixtures (volumetrics, materials, and surface texture), for the tracks to be constructed in France and Italy, in order to minimize noise from electric vehicles (EV).

An accurate plan of experiments was set up and followed in order to design and validate the mixtures.

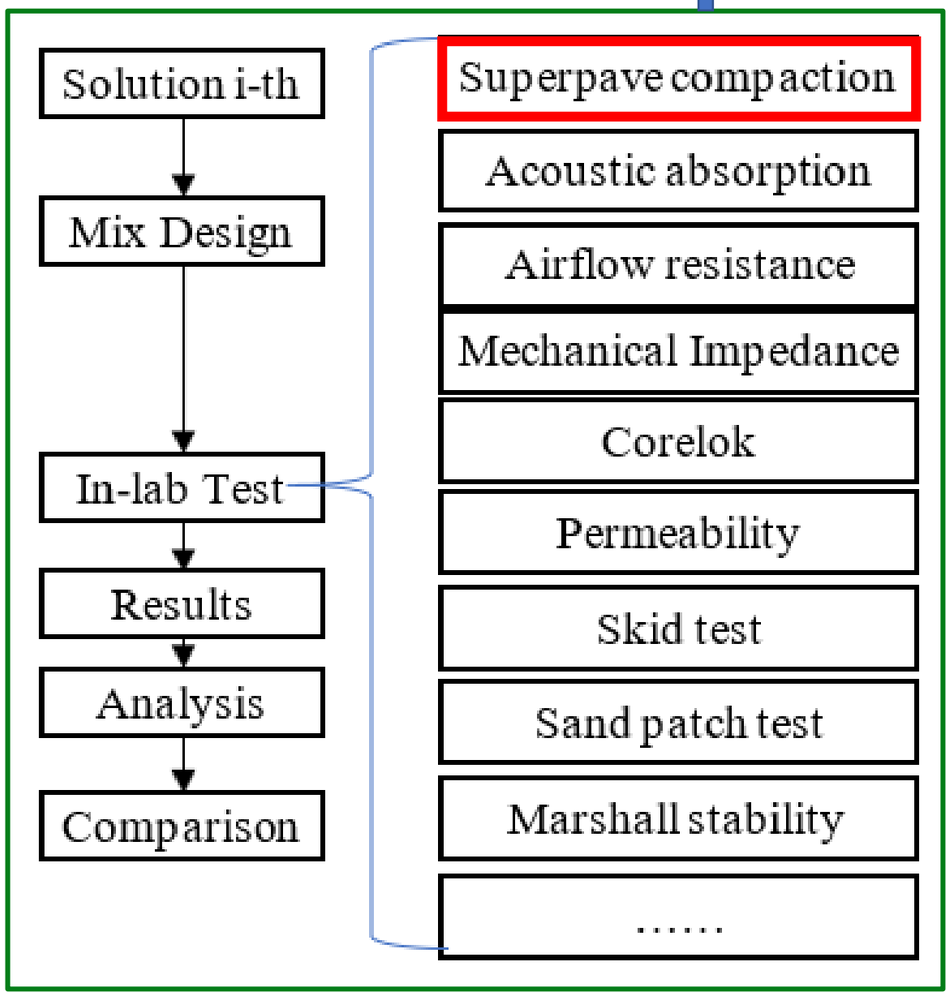
Two types of mixtures were finally designed **(AC6 with and without crumb rubber)**.



Plan of experiments

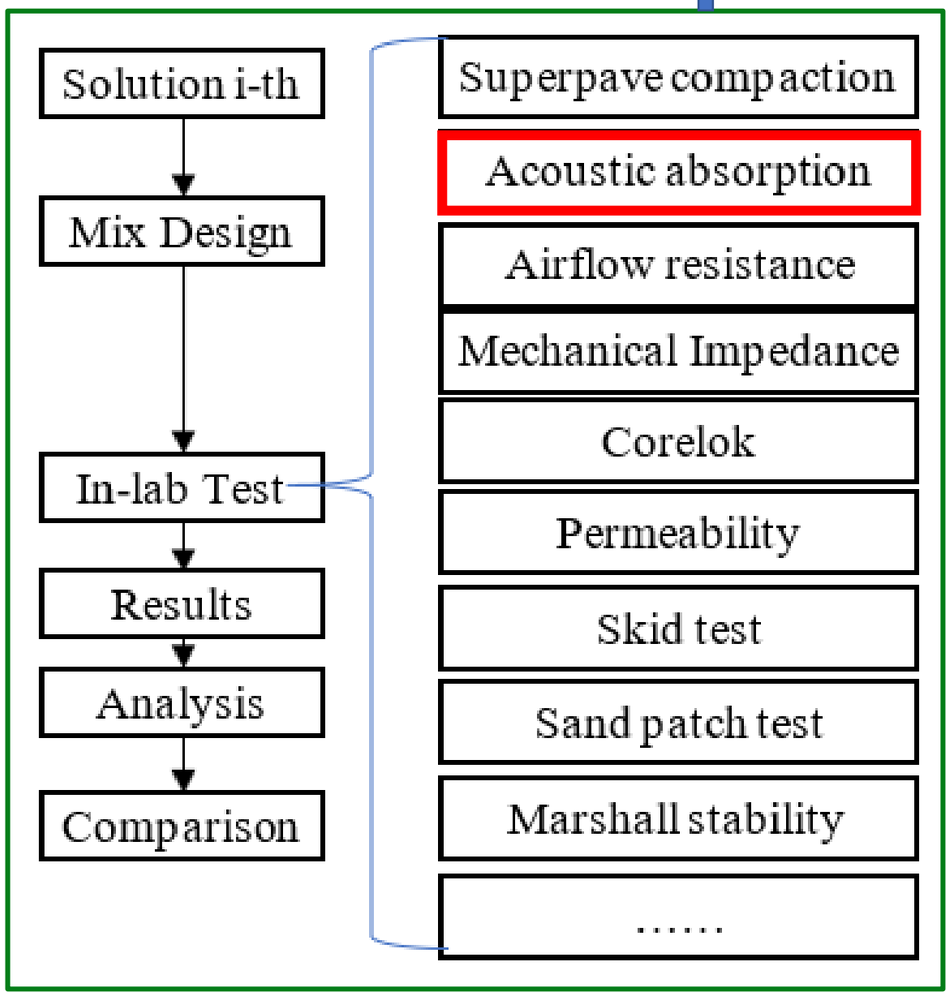
15/40. Focus on B1.1- B1.2- B1.5

Superpave compaction



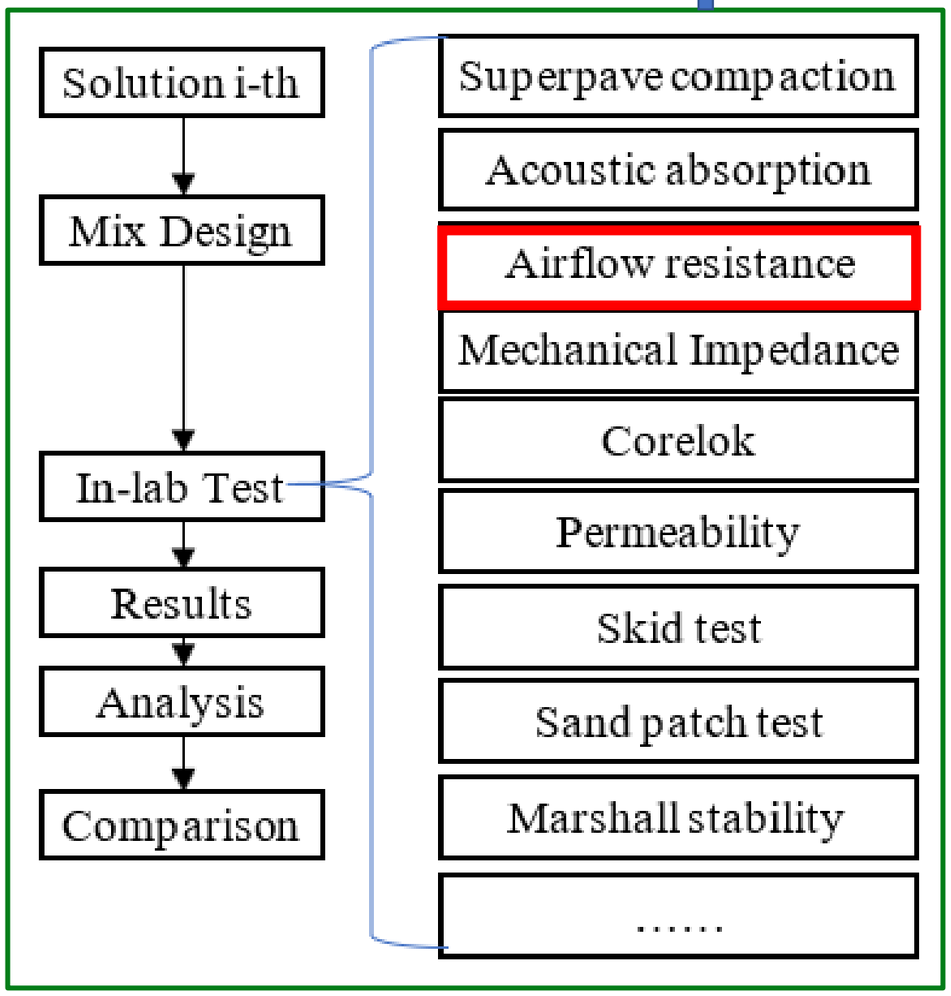
16/40. Focus on B1.1- B1.2- B1.5

Acoustic absorption

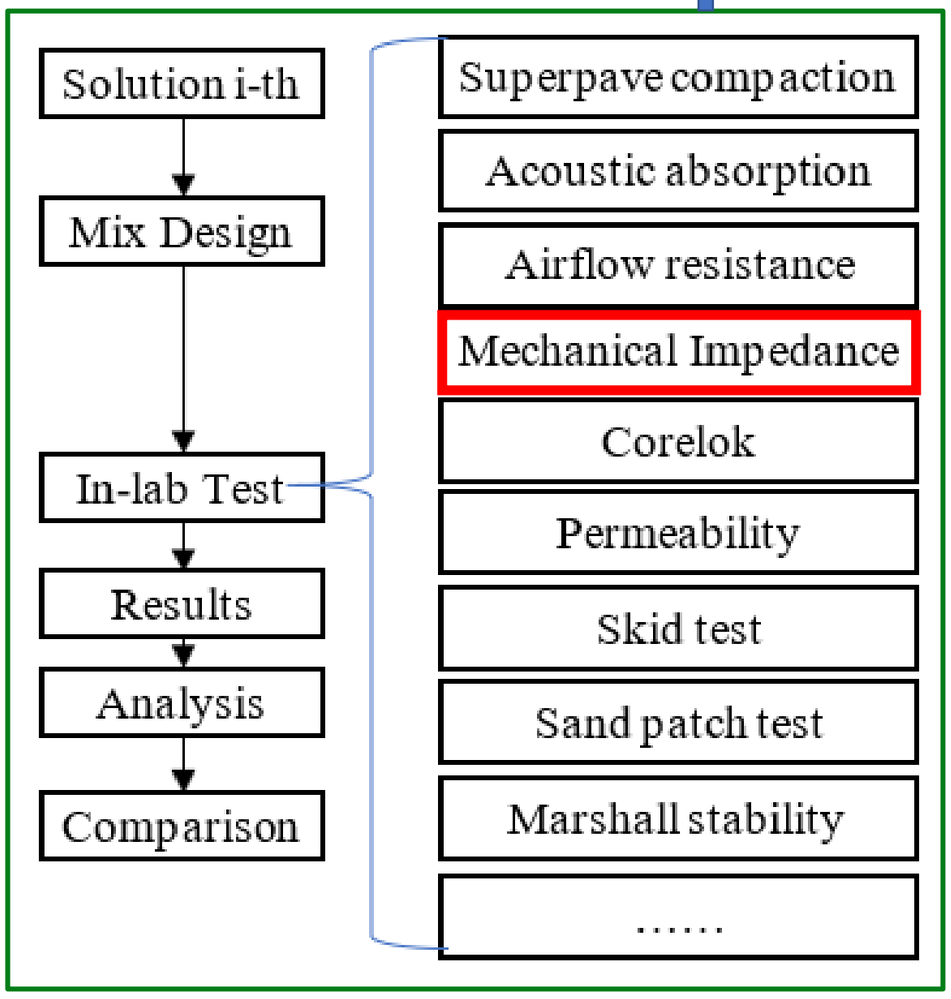


17/40. Focus on B1.1- B1.2- B1.5

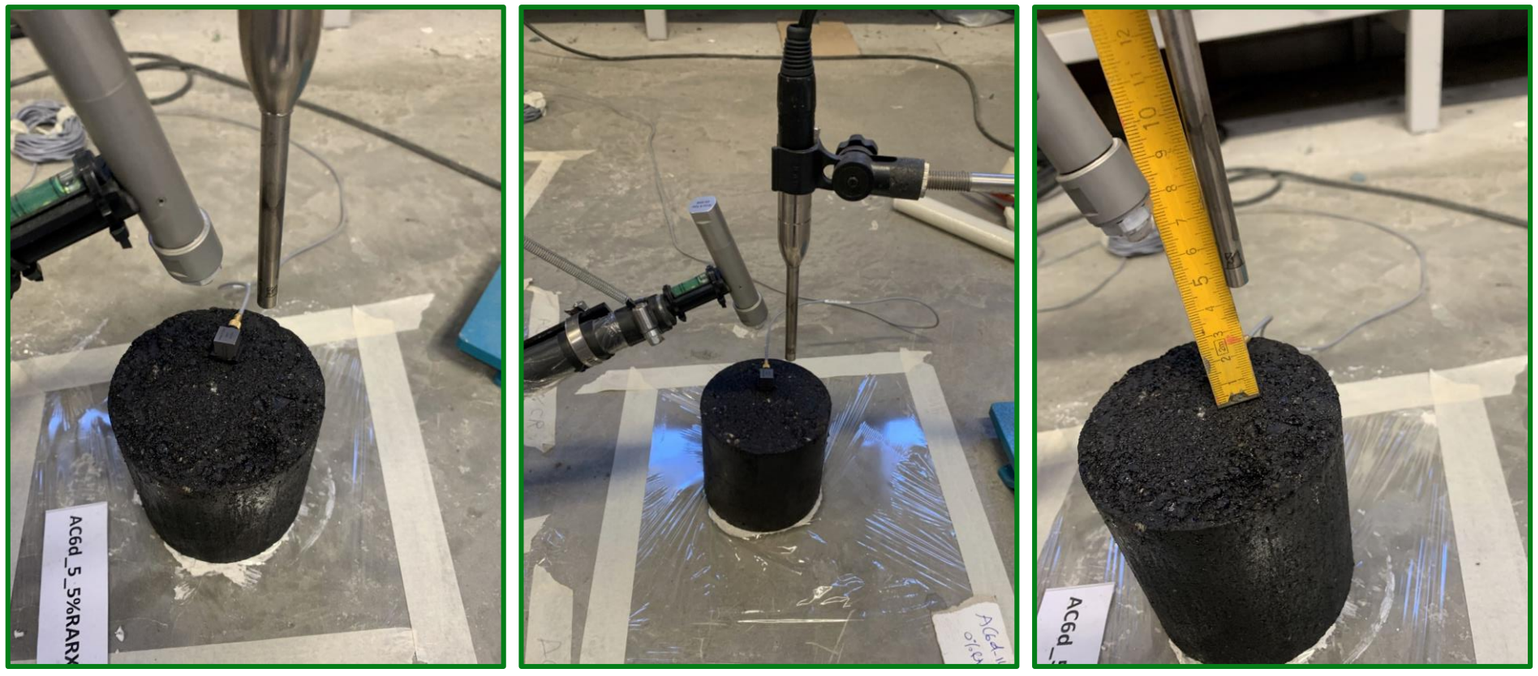
Airflow resistance



18/40. Focus on B1.1- B1.2- B1.5

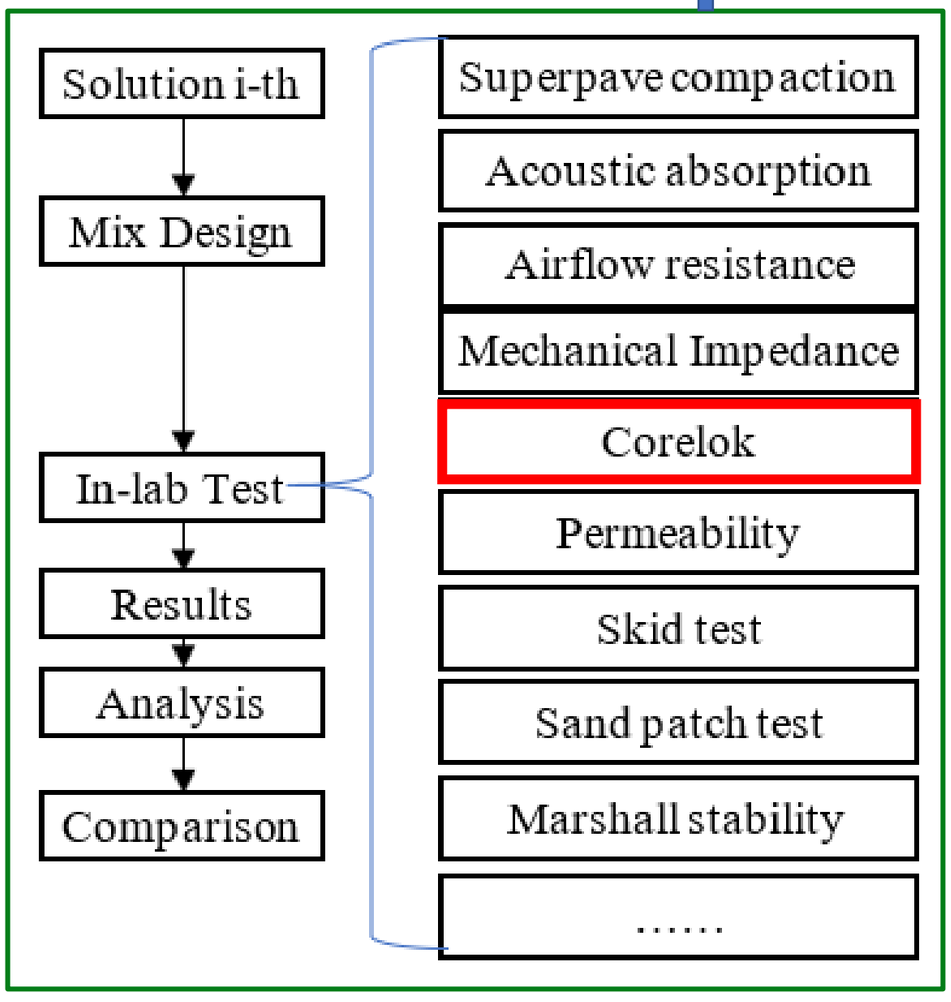


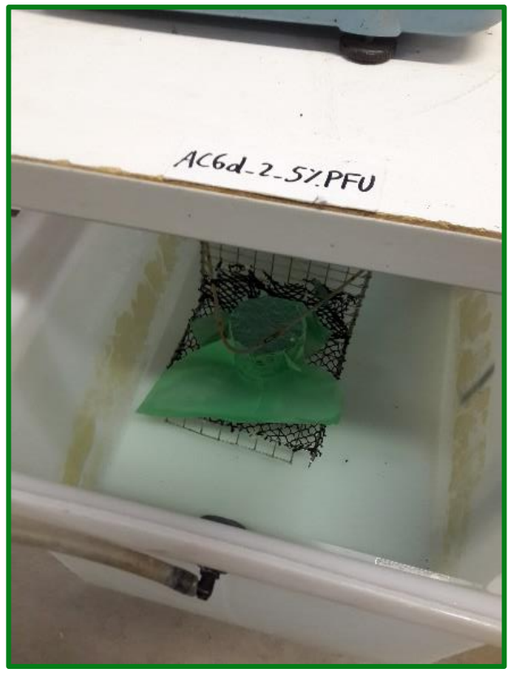
Mechanical Impedance



19/40. Focus on B1.1- B1.2- B1.5

Corelok





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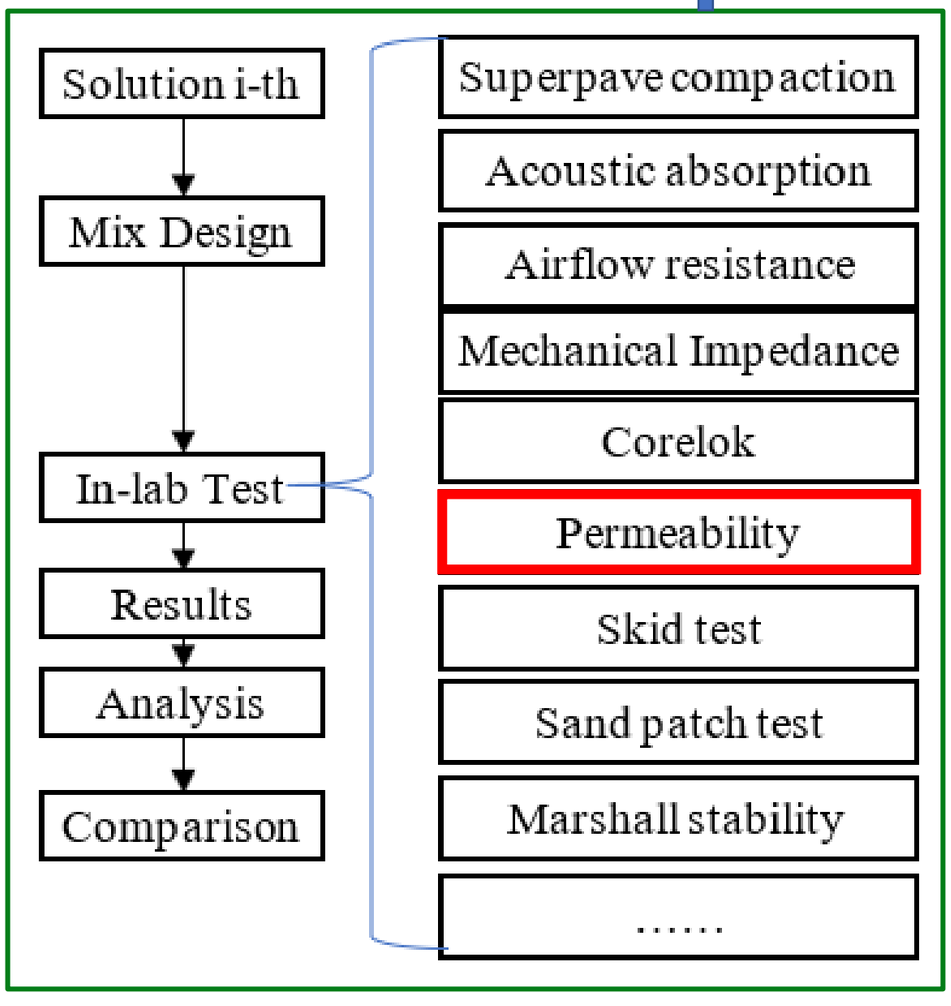
20/40. Focus on B1.1- B1.2- B1.5

Permeability



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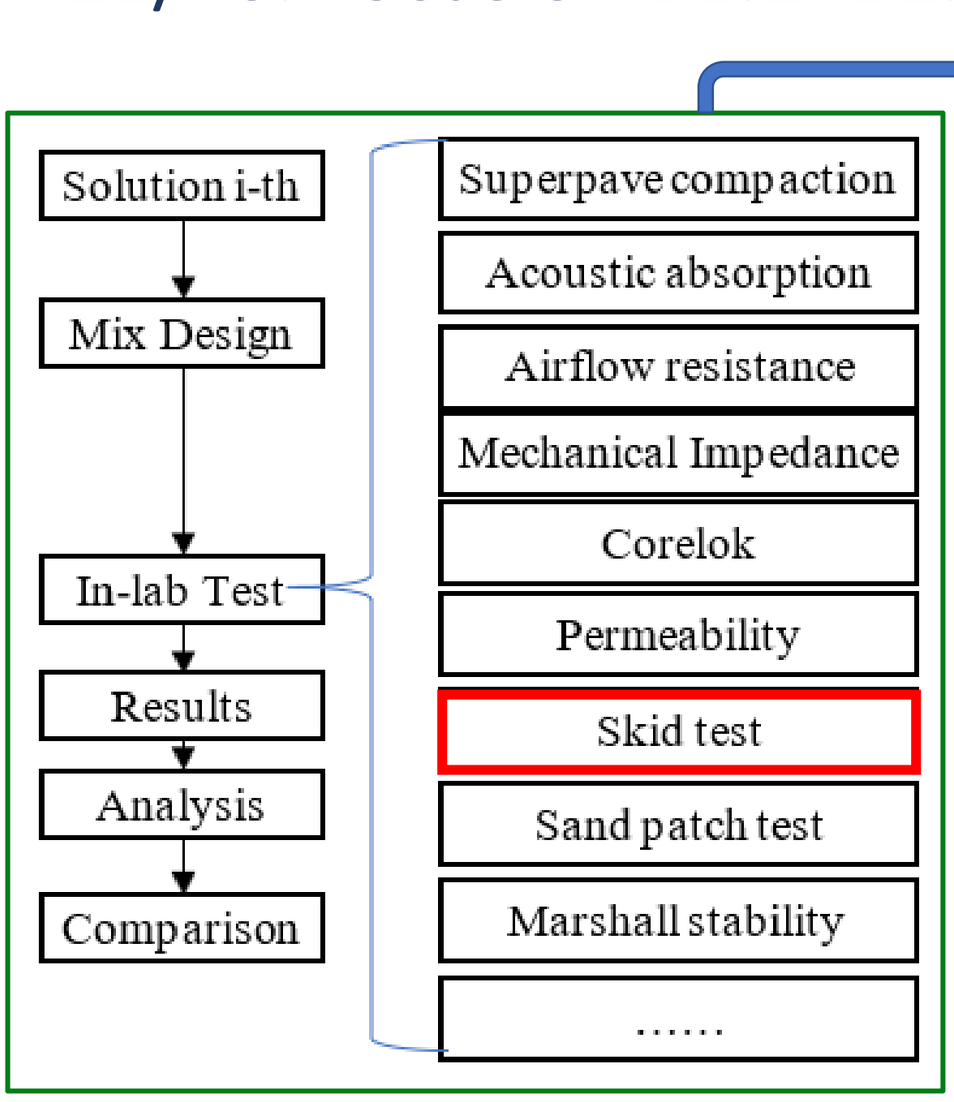
21/40. Focus on B1.1- B1.2- B1.5



Skid test

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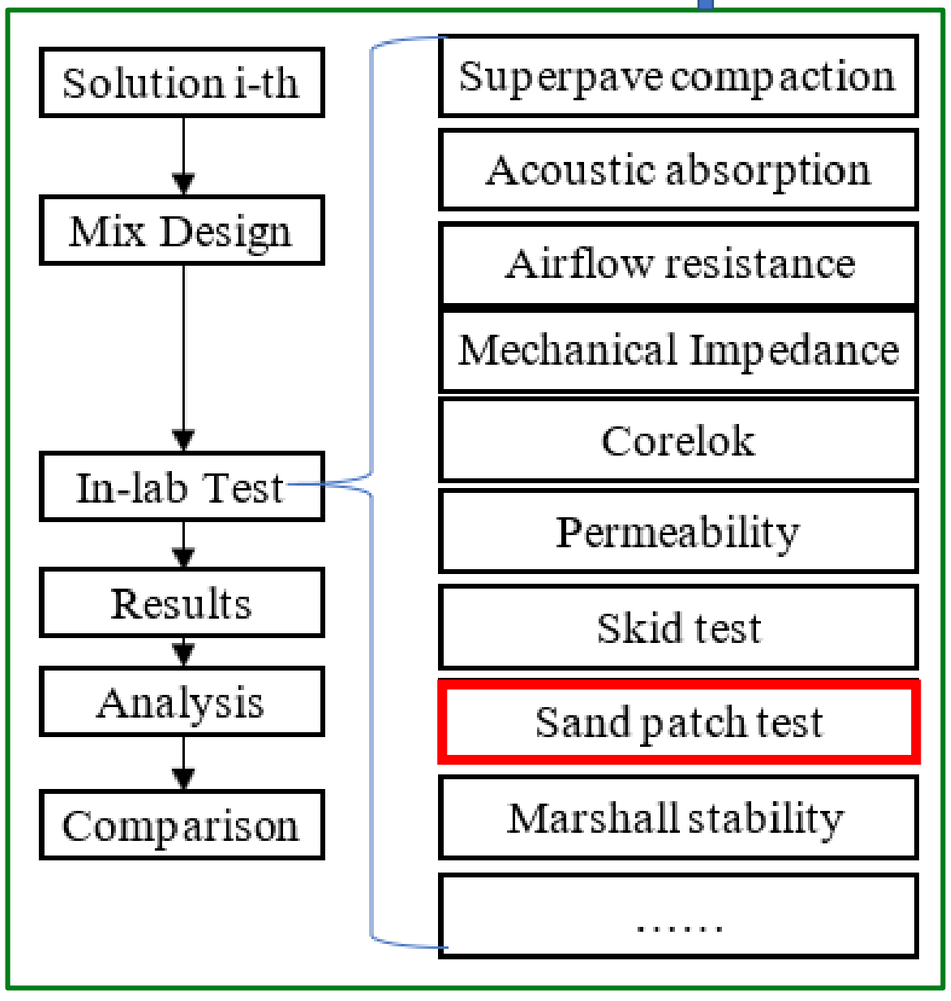
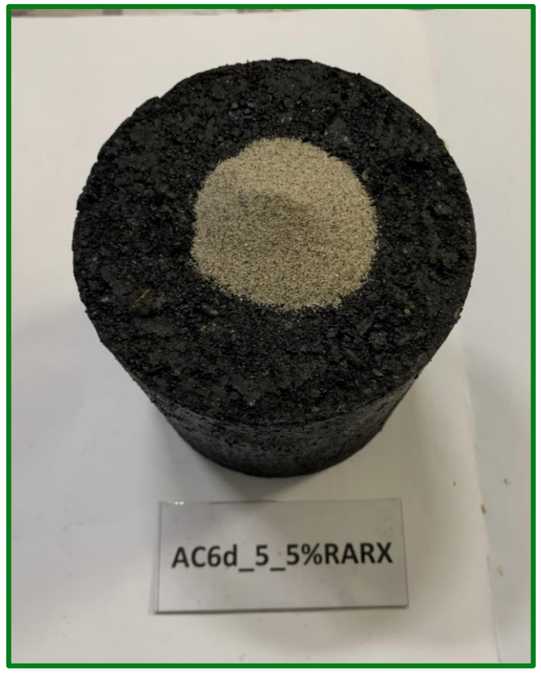
22/40. Focus on B1.1- B1.2- B1.5



Sand patch test



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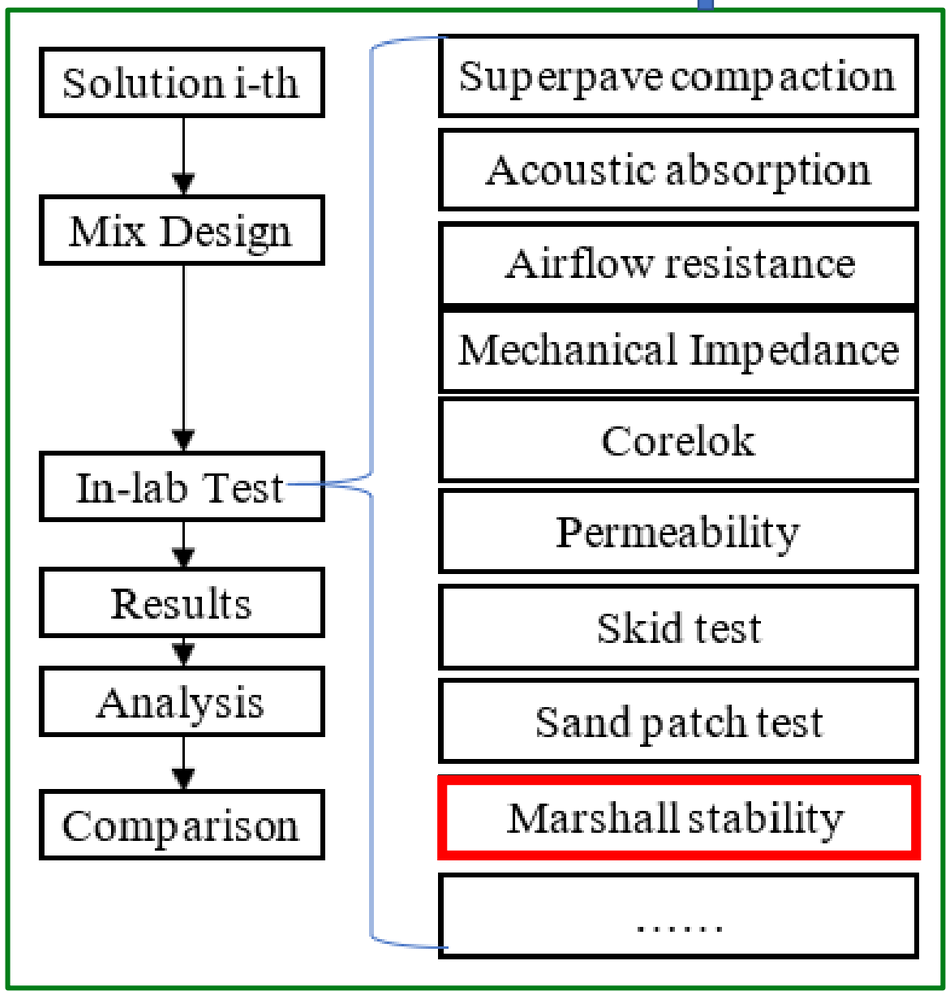
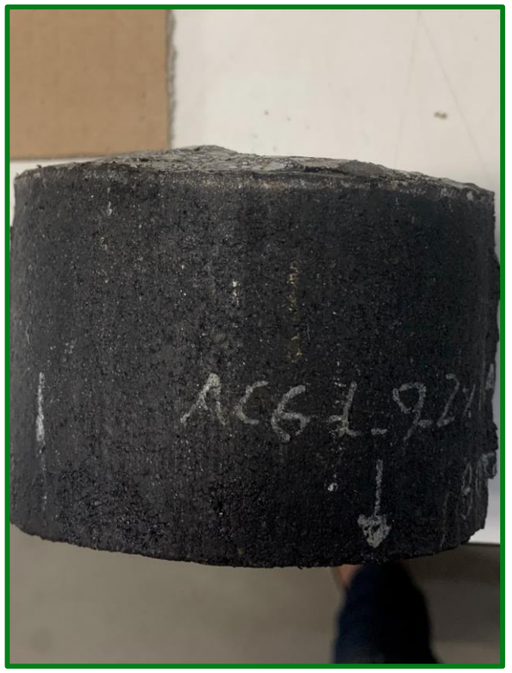
23/40. Focus on B1.1- B1.2- B1.5

Marshall stability





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24/40. B1 for B3

Sieve	% passing	Range
mm	%	±
8	100	0
5.6	92	3
4	80	5
2	58	5
1	35	5
0.5	24	5
0.25	18	3
0.063	10	2

B1

Fraction	Granulats	Formule étudiée	Formule contrôlée
4/6,3	Vairé	7,0%	7,0%
2/4	Vairé	33,0%	34,0%
0/2	Rouans	52,0%	52,6%
Fines d'apport		1,6%	retour filler : 7%
Bitume d'apport	COLFLEX		
Bitume total		6,40%	6,40%

Université Gustave Eiffel

Mixtures laid down in Nantes

Tests in Nantes

B1 analyses

Fraction	Granulats	Formule étudiée	Formule contrôlée
4/6,3	Vairé	7,0%	7,0%
2/4	Vairé	33,0%	33,0%
0/2	Rouans	51,0%	51,0%
0/1	RARX	1,9%	1,9%
Fines d'apport		1,0%	retour filler : 6,5%
Bitume d'apport	50/70	6,10%	6,10%
Bitume total		6,40%	6,40%

B2

B3

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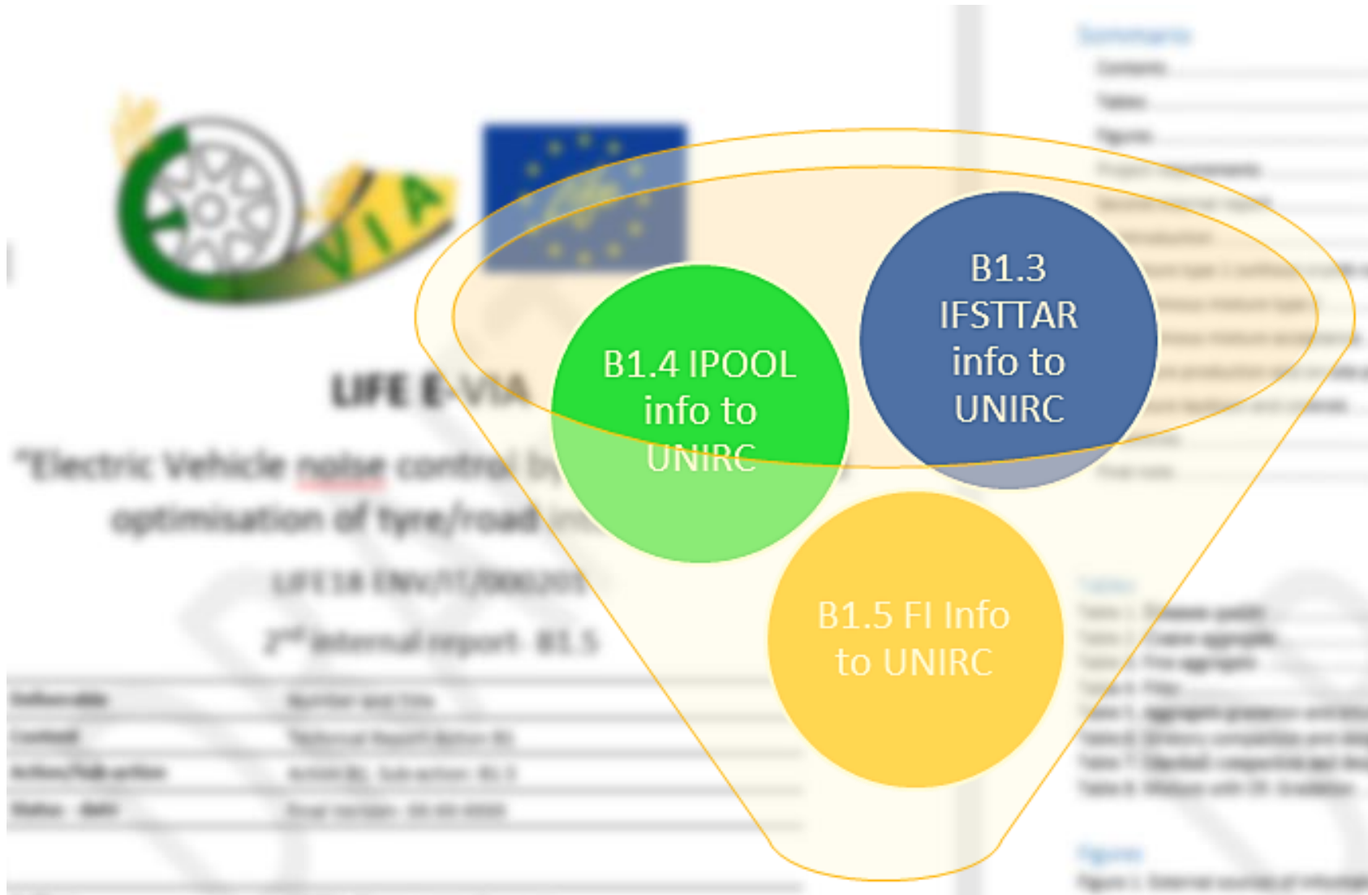
COMUNE DI FIRENZE

25/40. B1 for B3 (2nd internal report delivered)



B1.5: UNIRC info to FI (2nd internal report)

Action C2

Life cycle analysis (LCA) and life cycle costing (LCC) [scheduled: 07/2019-03/2023]

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27/40. Focus on C2

LCA-LCC project	Done
Project objectives: "2) To estimate the mitigation efficiency and potential of tyres, pavements and traffic (traffic spectrum, speeds, handling conditions) at a higher and comprehensive level: a Life Cycle Analysis (LCA) and a Life Cycle Cost Analysis (LCCA) will be performed to demonstrate the individual and synergistic efficiency of pavement surfaces, tyres and vehicles (including the comparison between internal combustion vehicles, mixed traffic, and EV traffic)" «7) To encourage low-noise surfaces implementation in further EU and extra-EU scenarios, demonstrating durability and sustainability, through in-depth LCA&LCCA"	LCA and LCC studies were carried out mostly pertaining to LCA for pavements, aiming at demonstrating their durability and sustainability (cf. paper published)
Actions and means involved: «C2: Life cycle analysis (LCA) and life cycle costing (LCC). These analyses will evaluate track efficiency from a comprehensive point of view, including soundscape components (B5), thus achieving obj.6 of demonstrating the durability and effectiveness through LCA/LCC. [UNIRC]"	See above.
Is your project significantly climate-related?: "3) The expected increase in EVs may not cause convenient savings of CO2 emission for the years under investigation: there is a need for facing effectively not only noise-related but also climate-related issues (LCA, LCC, cf. action C2)." "2) Tyre labels refer to fuel consumption, wet grip and noise classification. For fuel consumption, A class compared to G class can reduce it by 9%: a synergetic effort is needed to fit both noise-related and fuel-related (CO2 emission) targets. An attentive analysis of climate-related consequences as a sort of boundary condition is needed (LCA-LCC analyses, C2 action, see below)."	Here studies are in progress. Note that EVs have pros and contras that were studied (cf. keynote speech at SC4Life, 2019, Portugal)
Socio-economic effects of the project: "Additional social outcomes are foreseen because this project is going to encourage low-noise surfaces implementation, demonstrating durability and sustainability, through in-depth Life Cycle Analyses (LCA&LCCA, cf. Action C2)."	Here studies are in progress.
ACTION B.7: Holistic performances of tyres: "Besides delivering tyres to actions B2 and B3 and the EV festival, B7 will also deliver input data for the LCA/LCC in action C2."	Studies are in progress

28/40. Focus on C2

LCA-LCC project	Summary
C. Monitoring of the impact of the project actions (obligatory) *ACTION C.2:* Life cycle analysis (LCA) and life cycle costing (LCC) ***Description and methods employed (what, how, where, when and why):*** C2: Life cycle analysis (LCA) and life cycle cost analysis (LCCA/LCC). These analyses will evaluate tracks efficiency from a comprehensive point of view, including soundscape components (B5), thus achieving obj.6 of demonstrating the durability and effectiveness through LCA. C2 is going to be organized into sub-actions as follows. **Sub-action C.2.1** addresses LCA and LCC modelling. This section is going to be based on standards and on the literature. In more detail, for LCC, additionally, the model will consider not only internal costs (as known as agency costs and user costs) but also "external costs" (environmental ones). Importantly, based on the literature, noise performance is going to be considered, for both LCA and LCC analyses. To this end, note that the noise-related indicator (cf. Praticò, 2006, LCCA for silent surfaces) must consider: 1) vehicle speed; 2) number of vehicles; 3) the length of the road stretch; 4) the upper specification level of the concerned noise level. It is worth noting that noise performance is taken into account over time, which includes the consideration of the durability of noise performance. This implies considering the noise indicator dependency on pavement and on the durability of its concerned noise performance. This aspect is quite critical because an energetic approach is needed, where the overall acoustic energy produced by tyre-pavement interaction must be estimated. For durability, it is highlighted that the approach above intrinsically considers durability, because it entails the consideration of the noise level from the cradle to the grave.	Internal costs considered: 1) Cost of one square meter of pavement (friction course). 2) Maintenance costs. 3) Rehabilitation costs External costs considered: 1) Noise-related effects (see the point outlined into the proposal, including speeds, number of vehicles, geometry, limits, and durability). 2) Other environmental effects (due to the use of crumb rubber).

29/40. Focus on C2

LCA-LCC project	Done
Sub-action C.2.2 deals with the definition of scenarios. Functional unit will be specified and system boundaries will be identified (including raw materials, materials production, asphalt paving operations, maintenance and rehabilitation, transports, and end of life). Impact assessment methods, scenario definition, and life cycle inventory of each scenario will be addressed. Basically, the two primary scenarios refer to each of the two selected road sections. A series of supplementary scenarios are expected, among which: 1) a set of preliminary scenarios aiming at assessing the best option to use for the reference track and for the surface-optimized track. This set of scenarios is going to be influenced by many concurring tasks. In more detail, apart from the preliminary actions A, track design (B1), tyre-pavement studies (B2), final construction details (B3) and soundscape analyses (B5) will provide basic data for this action. After the construction of tracks, operation-related data will be provided by tests and analyses (B4, B5, B6, C1). Note that the replication and transfer plan (cf. B3.2) entails itself scenario that will be considered and improved.	**Scenarios. For** the following scenarios data gathering and analyses are in progress: 1&2) Scenario with the job mix formula set up without crumb rubber with internal combustion engine vehicles, ICEVs, or with electric vehicles, EVs. 3&4) Scenario with the job mix formula set up with crumb rubber with internal combustion engine vehicles, ICEVs, or with electric vehicles, EVs.

30/40. Focus on C2

LCA-LCC project	Done
Sub-action C.2.3 deals with data gathering. Data are going to be gathered from all the other actions and particularly: B1 (because the design basically defines all the characteristics), B3 (because construction-related activities provide real data), B5 (because soundscape-related actions provide insights in terms of noise-related impacts), B6 (data about emissions), and C2 (traffic-, climate-, operation-related data). Importantly, the same sustainability of the same activities of the project is going to be considered (primarily D1 and E1).	**Data.** For data, the following data were requested and partly/entirely received/gathered: B1 data (because the design basically defines all the characteristics, Leader **UNIRC**) Tyre-pavement studies (B2, Leader: **UGE**) Final construction details (B3, because construction-related activities provide real data. Leader: **FI**) Track efficiency tests in the pilot area (B4, Leader: **IPOOL**) Soundscape analyses (B5, because soundscape-related actions provide insights in terms of noise-related impacts. Leader: **VIENROSE**) Evaluation of EV noise emissions (B6, data about emissions. Leader: **IPOOL**) Project impact monitoring (C1, Leader **FI**) Other C2-related data (traffic-, climate-, operation-related data). Dissemination (D1/2, sustainability of activities. Leader: **VIENROSE**) Project management (E1/2, sustainability of activities. Leader: **FI**)

31/40. Focus on C2

LCA-LCC project	Done
Sub-action C.2.4 deals with results derivation and analyses. LCA results will be given in terms of different indicators, among which Global Energy Requirement (GER, for example in terms of Mj/m2), Carbon Footprint (CF, for example in terms of gCO2eq/m2), human health impacts (e.g., air pollution, PM, NOx and SO2, noise pollution), ecosystem impacts (e.g., Terrestrial acidification, Freshwater Ecotoxicity, Terrestrial ecotoxicity, Freshwater eutrophication). LCC results will be given in terms of euro (and euro per square meter). Importantly, for noise–related issues, it is noted that the analyses must include the consideration of the SEL, as well as the daily time of exposure. It is worth noting that: 1) Different types of Electrical Vehicles, EVs, will be considered (battery EVs, Plug-in hybrid EVs, Range-extended EVs, Hybrid EVs, Fuel cell EVs). 2) Different stages will be considered (raw materials, production, use, end-of-life); 3) Synergies with circular economy will be addressed (e.g., cradle to cradle, reuse and recycling consideration, cf. EEA Report No 13/2018). C.2 makes a contribution to the majority of the objectives. It affects objective 1 because noise reduction is crucial in LCA and in LCC assessments. Furthermore, C2 makes a contribution to objective 2. Data gathered from the remaining actions, particularly B4 and B6, will be used to assess the individual and synergistic "weight" of the different causes of traffic noise (the remaining factors being constant): pavement, tyres (focusing on what happens just changing the tyre), and EV type. Apart from the clear information emerging in terms of sound levels, the overall impact is going to be assessed through the LCA and LCC analyses. This is going to be the basis for editing guidelines as per objective 4, demonstrating the different sustainability of each solution (cf. objective 6). For the durability of low-noise surfaces (objective 6), it is noted that this property mainly depends on the following aspects: mechanical performance of the layer (fatigue resistance, modulus, shear resistance, surface texture, friction) and noise performance of the layer. Finally, for the sustainability (objective 6), the action C1 is going to make a contribution in terms of life cycle assessment, where the overall impact is going to be assessed through a wide spectrum of indicators such as the global energy requirement, the carbon footprint, and the noise impact.	Results: see the paper that was published. Further studies are in progress.

32/40. Focus on C2

These analyses will continue and will focus on evaluating tracks efficiency from a comprehensive point of view, including soundscape components (B5), thus achieving obj.6 of demonstrating the durability and effectiveness through LCA.
Data gathering are still in progress by UNIRC.

A first paper, *"Energy and Environmental Life Cycle Assessment of Sustainable Pavement Materials and Technologies for Urban Roads",* has been published. This is available on the website of the LIFE E-VIA project:
https://life-evia.eu/papers/papers-1-lorem-ipsum/

Energy and Environmental Life Cycle Assessment of Sustainable Pavement Materials and Technologies for Urban Roads

January 2020 · Sustainability 12(2):704 · Follow journal
DOI: 10.3390/su12020704
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Filippo Praticò · Marinella Giunta · Marina Mistretta · Teresa maria Gulotta

Università degli Studi Mediterranea di Reggio Calabria

Action D1

Information and awareness raising activities [scheduled: 07/2019-03/2023]

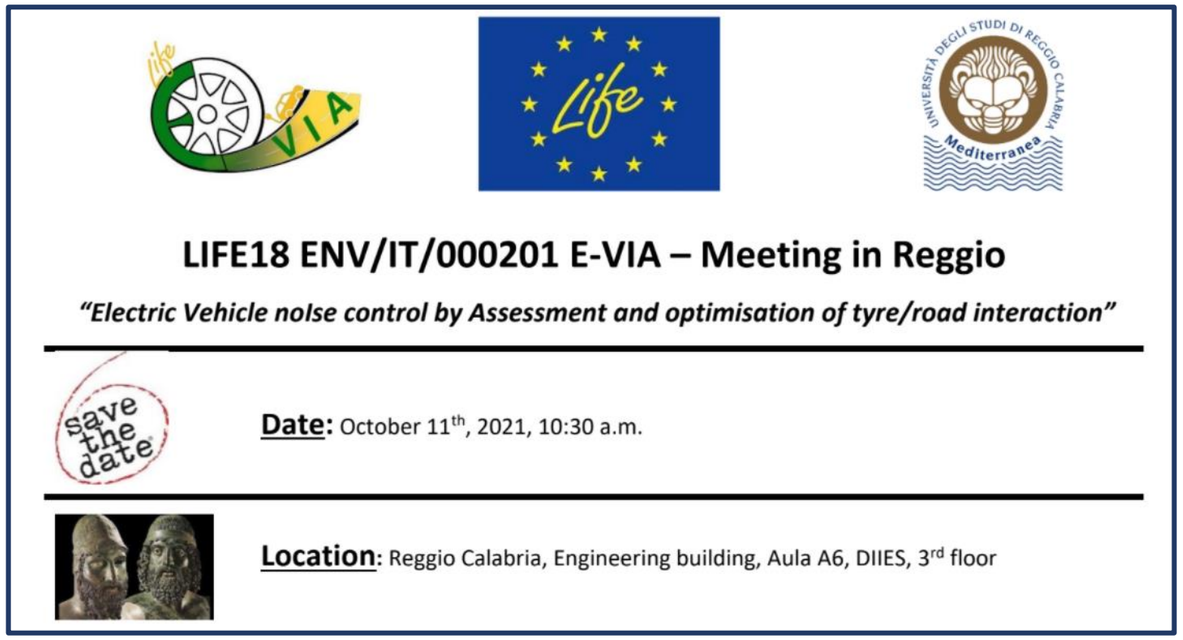
34/40. Focus on D1

The following papers have been submitted from the beginning of the LIFE E-VIA project:

"Energy and environmental life cycle assessment of sustainable pavement materials and technologies for urban roads"	Sustainability
"Particulate matter from non-exhaust sources"	ENVIRO Conference 2020
"The study of road pavement performance through impact hammer tests"	ENVIRO Conference 2020
"Smart road infrastructures through vibro-acoustic signature analyses"	4th International Symposium NEW METROPOLITAN PERSPECTIVES 2020
"Acoustic impact of electric vehicles"	20th IEEE Mediterranean Electronical Conference (MELECON) 2020
"Electric vehicles diffusion: changing pavement acoustic design?"	Journal Noise Mapping 2021
"Acoustical characterization of low-noise prototype asphalt concretes for electric vehicles"	Euronoise 2021 Congress
"Low-noise Road mixtures for electric vehicles"	Euronoise 2021 Congress

35/40. Focus on D1

The abstract of one paper has been submitted for the 51st International Congress and Exposition on Noise Control Engineering which will be held in Glasgow, from 21 to 24 August 2022.



LIFE18 ENV/IT/000201 E-VIA – Meeting in Reggio

"Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction"

save the date

Date: October 11th, 2021, 10:30 a.m.

Location: Reggio Calabria, Engineering building, Aula A6, DIIES, 3rd floor

The internal and technical progress project meeting in Reggio Calabria was held on October 11th, 2021.

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36/40. Focus on D2

Action D2

Technical dissemination activities to stakeholders [scheduled: 07/2019-03/2023]

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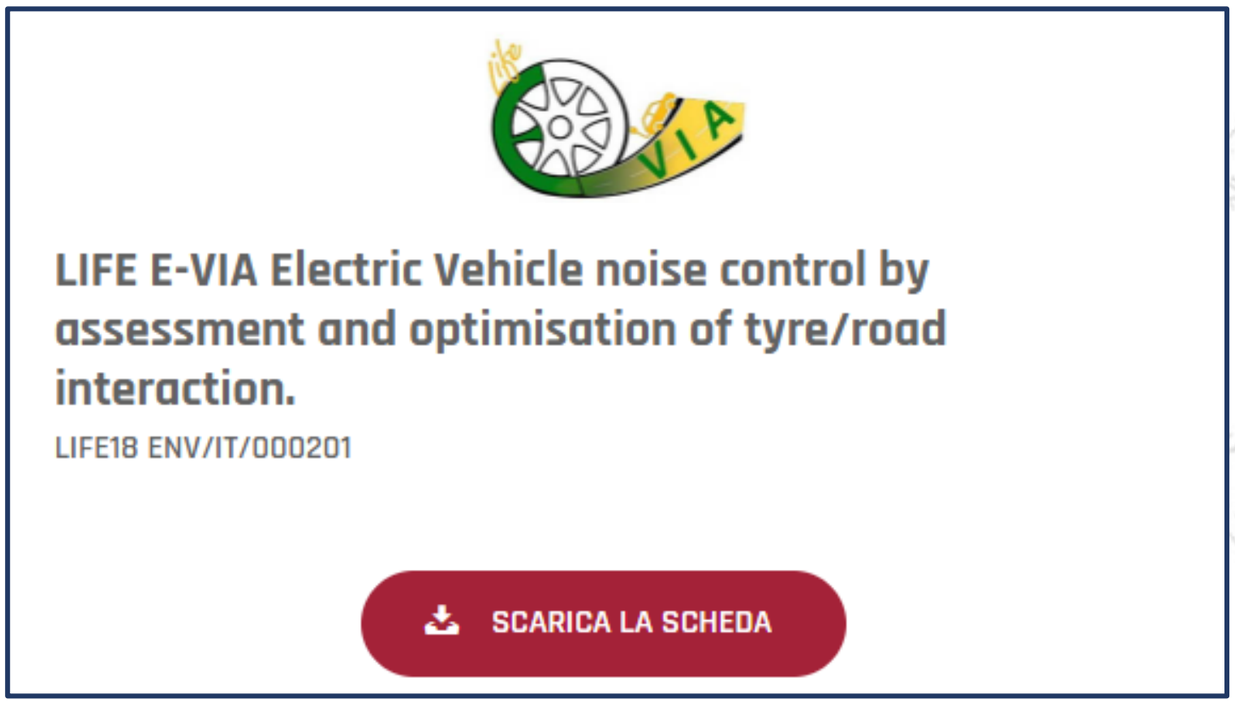
di Reggio Calabria

37/40. Focus on D2

An activity of dissemination of the LIFE E-VIA project has been made during the "Night of the Researchers" *(La notte dei ricercatori*) in Italy.



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38/40. Focus on D2

Note that a short presentation of the project E-VIA is reported on the website:
https://www.superscienceme.it/

Electric Vehicle noise control by assessment and optimisation of tyre/road interaction.

LIFE18 ENV/IT/000201. LIFE E-VIA

Partners

COMUNE DI FIRENZE
Continental The Future in Motion
iPOOL
Université Gustave Eiffel
Università degli Studi Mediterranea di Reggio Calabria
Vie en.ro.se. Ingegneria

Objectives
2 pavement solutions. 5 different EV types
One reference ICE vehicle. 3*6=18 types of tyres
LCA and LCCA (synergistic efficiency of pavement surfaces, tyres and vehicles)
Rolling noise coefficients (CNOSSOS-EU)
National and Italian regional policies
People's awareness of noise pollution and health effects
Reducing noise emission by 5 dB(A) and CO_2 emissions reduction (21%)
Low-noise surfaces: implementing in further EU and extra-EU scenarios

Web sites

http://life-evia.eu
http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=7210

39/40. Focus on D2.3 – Updates about the Contest

In the proposal above the following tasks, subtasks, and details were scheduled and stated as follows:

- Task D. Public awareness and dissemination of results
- Subtask D2.3 Organization of events/activities devoted to the project
- Workshop in Reggio Calabria, date tbd. Organizer: UNIRC; other partners will attend and present a scientific contribution. On this occasion the students' contest awarding (D1 action) will be organized.
- As a prize for this contest, a visit to the laboratory for tests on road, railways and airport materials of UNIRC, and a visit to CRD's R&D facilities in Hanover are foreseen and attentively considered in terms of costs. Prize: "it is foreseen to pay for the flight and hotel costs for the 2 students winners of the contest and for an accompanying teacher".

Due to the pandemic, the workshop and the contest underwent multiple rescheduling efforts. At the moment there is an agreement with the high school "Liceo Scientifico Alessandro Volta" of Reggio Calabria. Based on that, the meeting held in Reggio on October 11th, 2021 was already attended on line by a number of students of the high school above.

40/40. Focus on D2.3 – Updates about the Contest

The following table summarises the tentative roadmap for the contest:

When	Action	Details
October 11th, 2021	Three hours: E-VIA meeting already held	Meeting held in Reggio Calabria
February/March, 2022	Four hours times two mornings (8 hours)	Main topics: 1) Acoustics. 2) Tyre-pavement interaction. 3) Main devices (Kundt tube, mechanical impedance; Adrienne system; resistivity device)
February/March, 2022	Four hours at school "Volta"	Details and editing of the report
March/April, 2022	Contest on the Optimal EV sound	Tentative board: one representative per partner.
March/April, 2022	Trips and visits.	Visit to CRD's R&D facilities in Hanover and/or to other venues, as per final decisions.

LIFE E-VIA

Electric **V**ehicle no**I**se control by **A**ssessment and optimisation of tyre/ road interaction

www.life-evia.eu

Start : July 1st, 2019

End: March 31st, 2023

THANKS FOR YOUR ATTENTION

Università degli Studi 'MEDITERRANEA' di Reggio Calabria

LIFE E-VIA PROJECT – MONITORING VISIT
FEBRUARY 25th, 2022

With the contribution of the LIFE programme of the European Union

LIFE18 ENV/IT/000201

LIFE E-VIA

Electric **V**ehicle no**I**se control by **A**ssessment and optimisation of tyre/ road interaction

www.life-evia.eu

LIFE E-VIA PROJECT

Monitoring visit 25TH February 2022 - Firenze

Vienrose Ingegneria

Responsible for actions B5, D1 and D2

Raffaella Bellomini, Sergio Luzzi, **Chiara Bartalucci**, Sara Delle Macchie, Lucia Busa, **Francesco Borchi**, Gianfrancesco Colucci, Giulia Iannuzzi

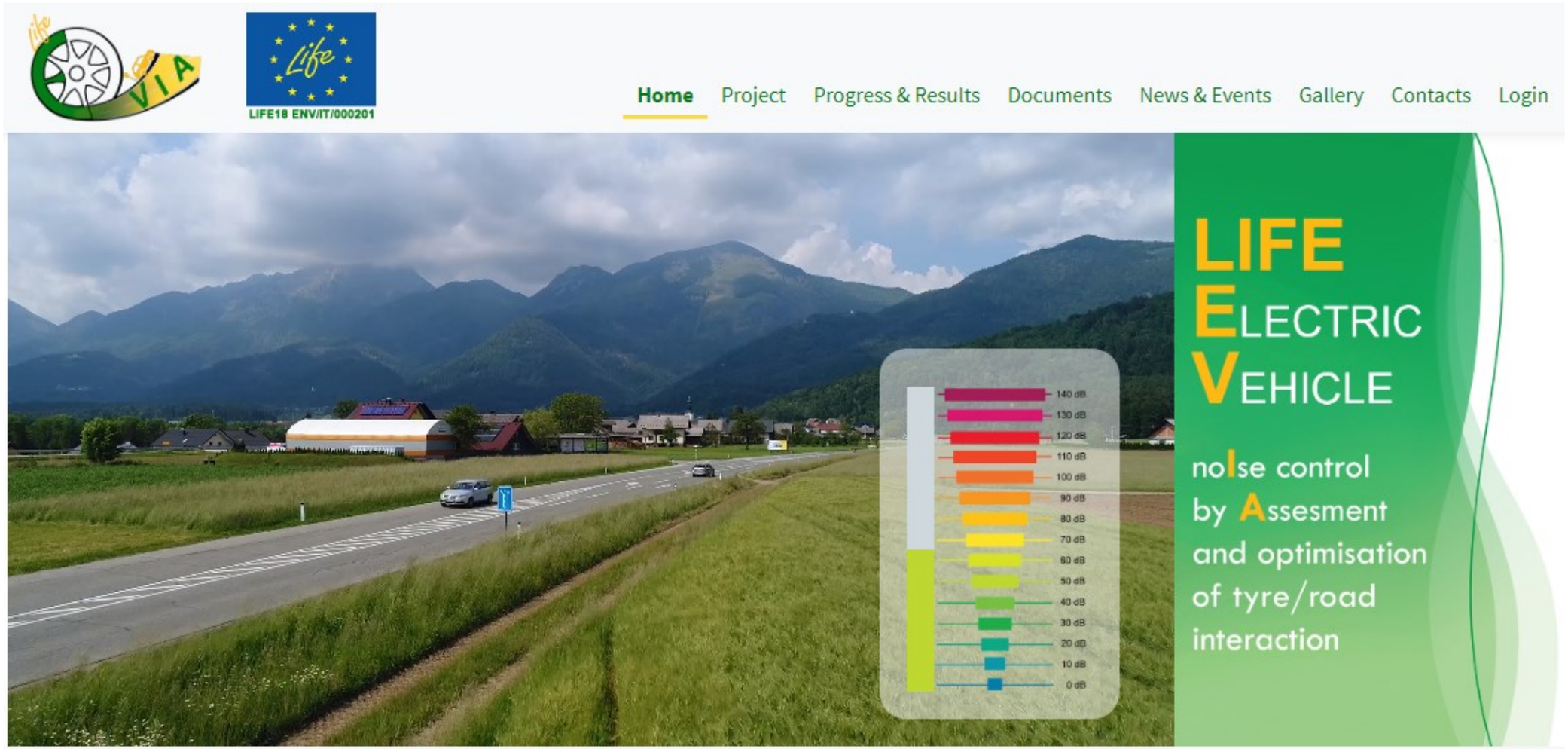
With the contribution of the LIFE programme of the European Union

LIFE18 ENV/IT/000201

ACTION D1

Website

http://life-evia.eu/



Report on statistics on Website visits

On a trimester basis a *Report on website design and statistics on visits* is drafted and published on the project website (not foreseen by project proposal).

LIFE E-VIA

"Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction"

LIFE18 ENV/IT/000201

Content	Report on website design and statistics on visits
Action/Sub-action	C1
Status - date	Final Version- 03-01-2022

Authors	Raffaella Bellomini, Chiara Bartalucci, Gianfrancesco Colucci, Sergio Luzzi (Vie en.ro.se)
Beneficiary	Municipality of Florence
Contact person	Arnaldo Melloni
E-mail	arnaldo.melloni@comune.fi.it
Project Website	https://life-evia.eu/

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2.2 Statistics for the period 1st April – 30 June 2020 11
2.3 Statistics for the period 1st July – 30 September 2020 17
2.4 Statistics for the period 1st October – 31 December 2020 24
2.5 Statistics for the period 1st January – 31 March 2021 30
2.6 Statistics for the period 1st April – 30 June 2021 35
2.7 Statistics for the period 1st July – 30 September 2021 40
2.8 Statistics for the period 1st October – 31st December 2021 45
3 Acknowledgments *51*

https://life-evia.eu/deliverables/additional-report-1_-report-on-website-design-and-statistics-on-visits/

Report on statistics on Website visits

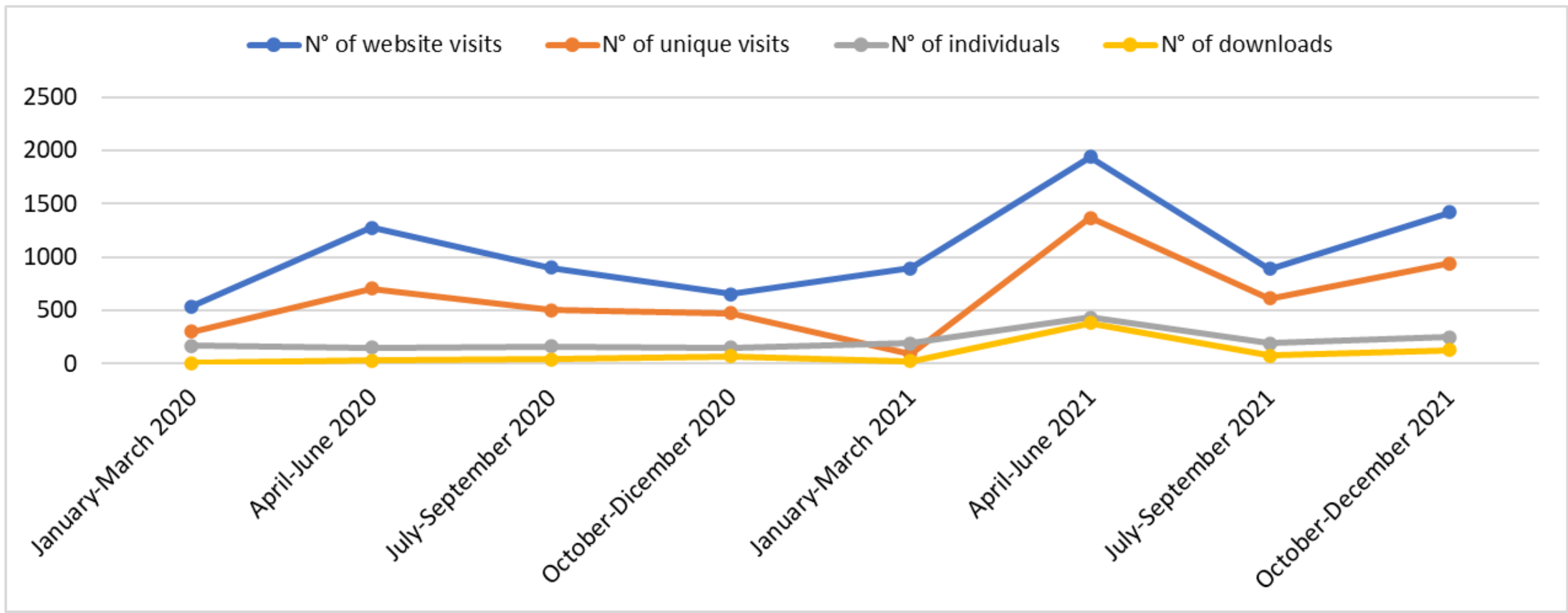
According to the filled **LIFE KPI indicators**, the values of the following indicator is requested to be provided at the end of the project and three years after its conclusion:

- n° of unique visits

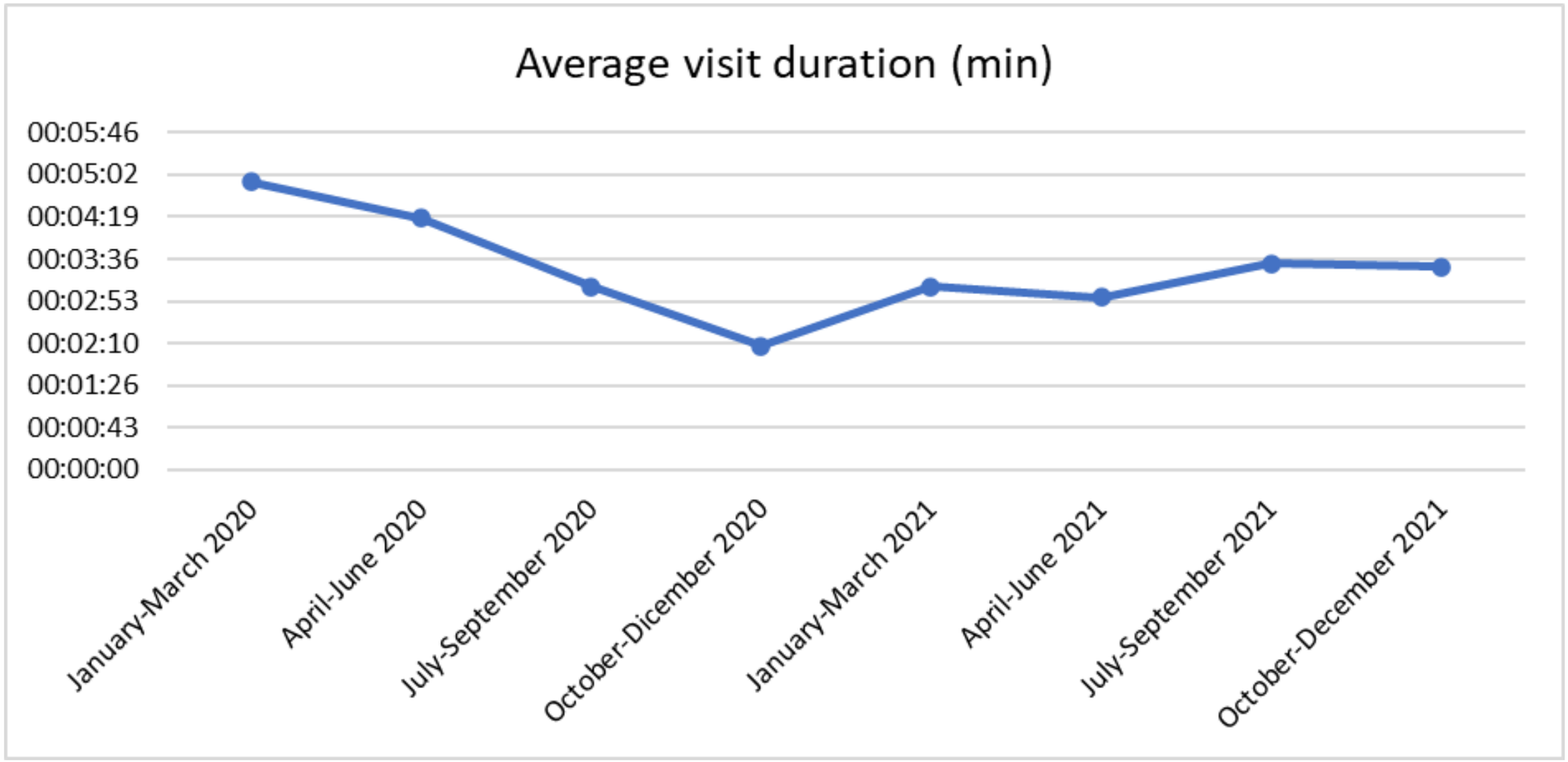
In addition to the mandatory statistics to be provided according the Project's proposal and the KPI, **further indicators** are analysed and reported:

- n° of individuals
- n° of download
- average visit duration
- typology of access: direct to the website link or indirect
- country of origin of the device
- most visited pages
- typology of device used by visitors to connect

Report on statistics on Website visits



Report on statistics on Website visits

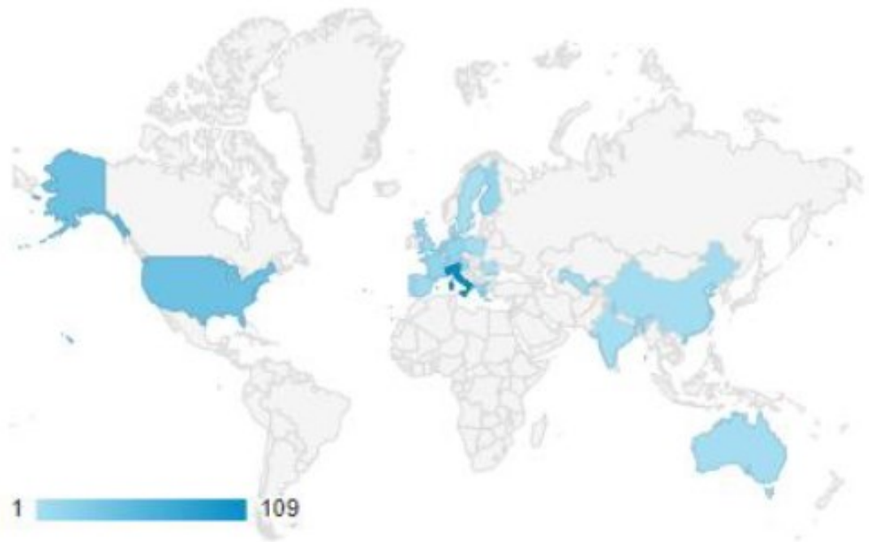


LIFE18 ENV/IT/000201
LIFE E-VIA PROJECT
25 February 2022 - Vie en.ro.se Ingegneria

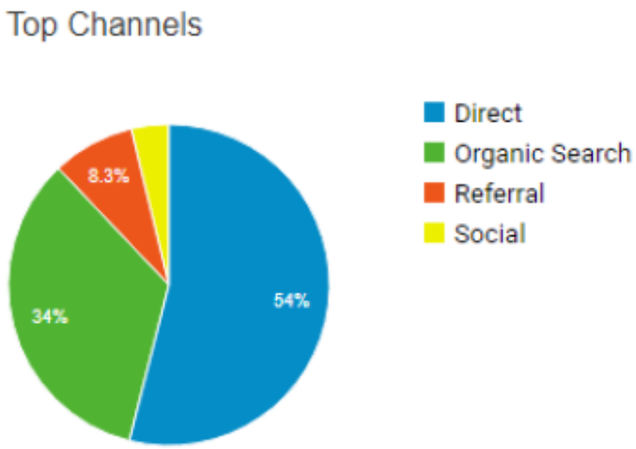
Report on statistics on Website visits

Some additional indicators

Map of Countries of origin of the connected devices

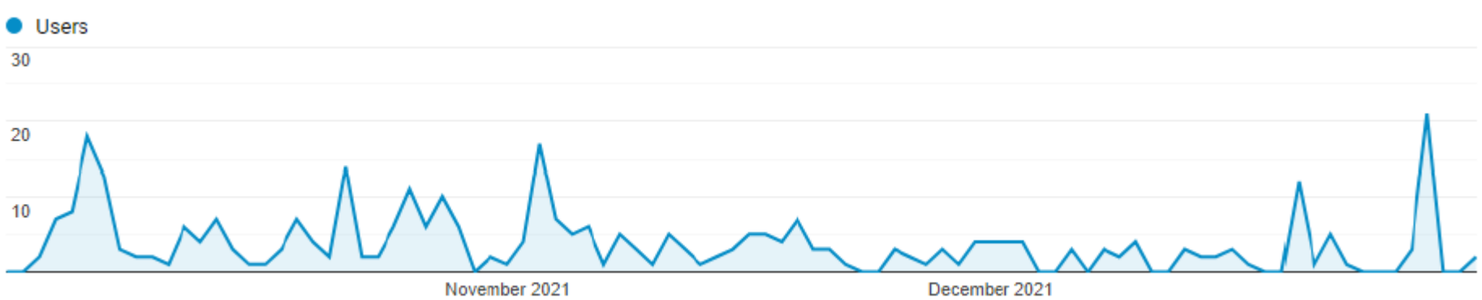


Percentage of direct vs indirect connections



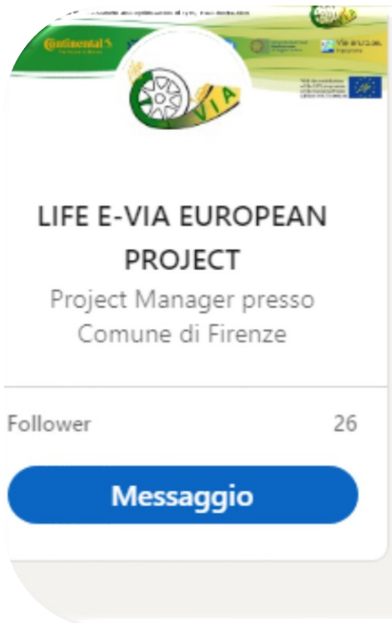
Percentage of New visitors vs Returning visitors

Trend of website visits



Social networks

Facebook page: 132 followers – 30 post (period 1/7/2020-31/12/2021)
Linkedin account: 34 followers – 30 post (period 1/7/2020-31/12/2021)



Statistics on social networks

Period January 2020-December 2020 vs January 2021-December 2021

Sessions: 71.38%

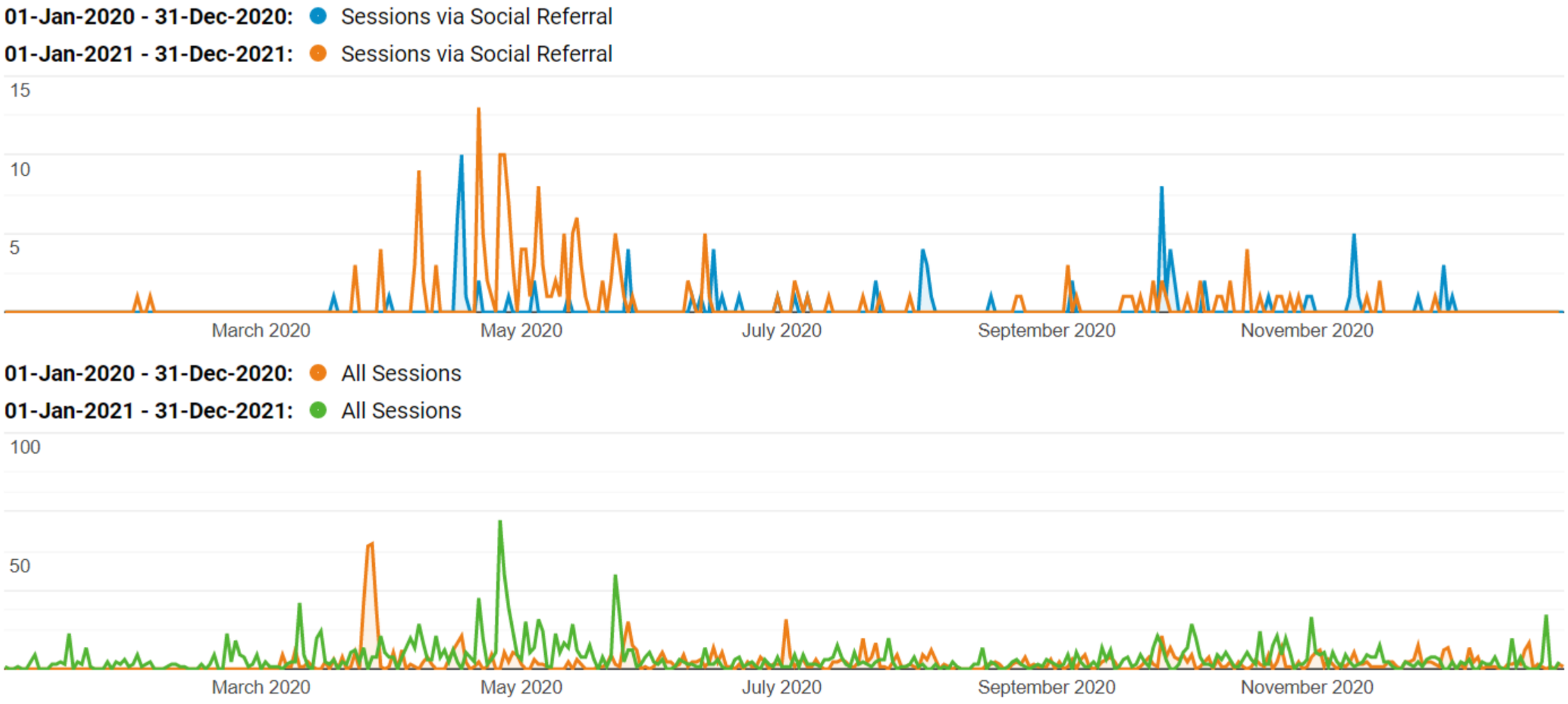
1,635 vs 954

Sessions via Social Referral: 125.88%

Social Network	Sessions
1. Facebook	
01-Jan-2021 - 31-Dec-2021	**121** (63.02%)
01-Jan-2020 - 31-Dec-2020	**71** (83.53%)
% Change	**70.42%**
2. LinkedIn	
01-Jan-2021 - 31-Dec-2021	**66** (34.38%)
01-Jan-2020 - 31-Dec-2020	**10** (11.76%)
% Change	**560.00%**

Statistics on social networks

Period January 2020-December 2020 vs January 2021-December 2021



Dissemination Plan – structure

TYPE OF ACTION	DELIVERABLES	CODE
Dissemination products	Dissemination Plan	1
	Life E-VIA Website	3
	Noticeboard in English language	18
	Noticeboard in French language	21
	Noticeboard in German language	22
	Noticeboard in Italian language	23
	Scientific papers	36
	Article published in open access top ranked journal	15
	Article for local magazines about EV Festival	16
	Articles for peer-reviewed open access journal	20
	Open Source Articles on peer-reviewed international journal	19
	Report on yearly participation in INAD	25
	Layman's report	35
Promotion activities	Press conferences	11
	Radio campaign	17
	Video of the prototype construction	8
	Promotional video about EV FESTIVAL	26
Events	Final event in Florence	37
	Workshop in Reggio Calabria	24
	Events	E
	Six-monthly meetings of the EUROCITIES	M

Dissemination Plan – timeline 1/3

LIFE E-VIA (LIFE18 ENV/IT/000201)
DISSEMINATION PLAN

TYPE OF ACTION	DELIVERABLES	CODE	2019				2020											
			9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Dissemination products	Dissemination Plan	1	1															
	Life E-VIA Website	3				3												
	Noticeboard in English language	18						18_1; 18_2										
	Noticeboard in French language	21																
	Noticeboard in German language	22																
	Noticeboard in Italian language	23																
	Scientific papers	36				36_1			36_2		36_3; 36_4	36_5					36_6	
	Article published in open access top ranked journal	15																
	Article for local magazines about EV Festival	16																
	Articles for peer-reviewed open access journal	20					20_1											
	Open Source Articles on peer-reviewed international journal	19																
	Report on yearly participation in INAD	25																
	Layman's report	35																
Promotion activities	Press conferences	11																
	Radio campaign	17																
	Video of the prototype construction	8																
	Promotional video about EV FESTIVAL	26																
Events	Final event in Florence	37																
	Workshop in Reggio Calabria	24																
	Events	E	E_1															
	Six-monthly meetings of the EUROCITIES	M		M_1														

Dissemination Plan – timeline 2/3

LIFE E-VIA (LIFE18 ENV/IT/000201)
DISSEMINATION PLAN

TYPE OF ACTION	DELIVERABLES	2021											
		1	2	3	4	5	6	7	8	9	10	11	12
Dissemination products	Dissemination Plan												
	Life E-VIA Website												
	Noticeboard in English language									18_3; 18_4			18_5
	Noticeboard in French language							21_1		21_2			
	Noticeboard in German language					22_1				22_2			22_3
	Noticeboard in Italian language					23_1				23_2			23_3; 23_4
	Scientific papers					36_7; 36_8	36_9	36_11; 36_12	36_13		36_14; 36_15; 36_16		
	Article published in open access top ranked journal						15						
	Article for local magazines about EV Festival												
	Articles for peer-reviewed open access journal												20_2
	Open Source Articles on peer-reviewed international journal												
	Report on yearly participation in INAD							25_1					
	Layman's report												
Promotion activities	Press conferences				11_a								
	Radio campaign												
	Video of the prototype construction						8						
	Promotional video about EV FESTIVAL												
Events	Final event in Florence												
	Workshop in Reggio Calabria												
	Events	E_2				E_3					E_4	E_5	
	Six-monthly meetings of the EUROCITIES				M_2								

Dissemination Plan – timeline 3/3

LIFE E-VIA (LIFE18 ENV/IT/000201)
DISSEMINATION PLAN

TYPE OF ACTION	DELIVERABLES	2022												2023		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Dissemination products	Dissemination Plan															
	Life E-VIA Website															
	Noticeboard in English language	18_6														
	Noticeboard in French language	21_3														
	Noticeboard in German language	22_4														
	Noticeboard in Italian language															
	Scientific papers															
	Article published in open access top ranked journal															
	Article for local magazines about EV Festival															
	Articles for peer-reviewed open access journal															
	Open Source Articles on peer-reviewed international journal															
	Report on yearly participation in INAD															
	Layman's report															
Promotion activities	Press conferences															
	Radio campaign															
	Video of the prototype construction															
	Promotional video about EV FESTIVAL															
Events	Final event in Florence															
	Workshop in Reggio Calabria															
	Events															
	Six-monthly meetings of the EUROCITIES															

Dissemination Plan – detailed activities 1/4

Dissemination Plan Ref.n.	Deadline	Code	Issued on	Description
1	01/09/2019			Dissemination plan
		1	September 2019	Start of dissemination activities
2	01/12/2019			Life E-VIA Website
		3	December 2019	Development and launch of LIFE E-VIA website www.life-evia.eu
3	31/12/2021			Video of the prototype construction
		8	June 2021	Video of the prototype construction in Nantes "Low-noise road surface prototype for electric vehicles"
4	31/07/2022			Press conferences
		11_a	April 2021	Press release: " A San Jacopino arriva l'asfalto anti rumore: Firenze città pilota in Europa per la sperimentazione"
		11_b		
		11_c		
5	31/12/2022			1 Article published in an open access top ranked journal
		15	June 2021	Article published in an open access journal NOISE MAPPING: "Road surface influence on electric vehicle noise emission at urban speed"
6	31/12/2022			1 Article for local magazines about EV Festival
		16		
7	31/12/2022			1 Radio campaign
		17		
8	31/12/2022			Noticeboard in English language **printed in almost 100/300 copies each**
		18_1	February 2020	LIFE E-VIA: objectives and actions (EN)
		18_2	February 2020	LIFE E-VIA: Roll-up (EN)
		18_3	September 2021	LIFE E-VIA: the pilot case (EN)
		18_4	September 2021	LIFE E-VIA: laboratory experiments (EN)
		18_5	December 2021	LIFE E-VIA: survey ante/post operam (EN)
		18_6	January 2022	LIFE E-VIA: Tyre role in the context of EV and ICEV (EN)
		18_7		
		18_8		
		18_9		
		18_10		
		18_11		
		18_12		
		18_13		
		18_14		
		18_15		

Dissemination Plan – detailed activities 2/4

Dissemination Plan Ref.n.	Deadline	Code	Issued on	Description
9	31/12/2022			2 Open Source Articles on peer-reviewed international journal for dissemination of the obtained results
		19_1		
		19_2		
10	31/12/2022			3 Articles for peer-reviewed open access journal (e.g., Materials, MDPI and Applied Acoustics)
		20_1	January 2020	Paper published on Open Access Sustainability 2020 about the sustainable pavement materials for the urban roads.
		20_2	December 2021	Paper published on the special issue "Understanding the impact of emobility on urban noise pollution" of the Journal "NoiseMapping"
		20_3		
11	31/12/2022			Noticeboard in French language **printed in almost 100/300 copies each**
		21_1	July 2021	LIFE E-VIA: objectives and actions (FR)
		21_2	September 2021	LIFE E-VIA: the pilot case (FR)
		21_3	January 2022	LIFE E-VIA: laboratory experiments (FR)
		21_4	September 2022	LIFE E-VIA: OPTIMISATION DU BRUIT DE CONTACT PNEUMATIQUE/ CHAUSSEE POUR LES VEHICULES ELECTRIQUES
		21_5		
12	31/12/2022			Noticeboard in German language **printed in almost 100/300 copies each**
		22_1	May 2021	LIFE E-VIA: objectives and actions (DE)
		22_2	September 2021	LIFE E-VIA: the pilot case (DE)
		22_3	December 2021	LIFE E-VIA: laboratory experiments (DE)
		22_4	January 2022	LIFE E-VIA: Tyre role in the context of EV and ICEV (DE)
		22_5		
13	31/12/2022			Noticeboard in Italian language **printed in almost 100/300 copies each**
		23_1	May 2021	LIFE E-VIA: objectives and actions (IT)
		23_2	September 2021	LIFE E-VIA: the pilot case (IT)
		23_3	December 2021	LIFE E-VIA: laboratory experiments (IT)
		23_4	December 2021	LIFE E-VIA: survey ante/post operam (IT)
		23_5		
14	31/12/2022			Proceedings of workshop in Reggio Calabria and students' contest awording (USB Keys) - 50 copies
	Workshop in Reggio	24		
15	31/12/2022			Report on yearly participation in INAD (3 reports 2020,2021,2022)
		25_1	July 2021	Report INAD Italia 2020-2021
		25_2		
		25_3		
16	31/01/2023			1 promotional video about EV FESTIVAL
		26		
17	31/01/2023			Layman's report
		35		

Dissemination Plan – detailed activities 3/4

Dissemination Plan Ref.n.	Deadline	Code	Issued on	Description
18	31/03/2023			Scientific papers to be presented in national/international congresses
		36_1	December 2019	Scientific contribution about the project in the EAI SmartCity 360° 2019 International Summit.
		36_2	March 2020	JTAV 2020: (ille-France) "LIFE E-VIA: noise control of electric vehicles by optimizing tire-road interaction"
		36_3	May 2020	Paper submitted to: 11th International Conference "Environmental Engineering" (ENVIRO)
		36_4	May 2020	Paper submitted to: 4th International Symposium "NEW METROPOLITAN PERSPECTIVES"
		36_5	June 2020	Paper submitted to the international conference: 20th IEEE Mediterranean Elettronical Conference (MELECON)
		36_6	November 2020	Paper submitted to Forum Acusticum Congress "LIFE E-VIA project: noise, electric vehicles and tyres"
		36_7	May 2021	Presentation to AIA Congress " IL PROGETTO LIFE E-VIA: CONTROLLO DEL RUMORE DEI VEICOLI ELETTRICI MEDIANTE VALUTAZIONE E OTTIMIZZAZIONE DELL'INTERAZIONE PNEUMATICO/ASFALTO"
		36_8	May 2021	Presentation of the project to the European Tire and Rim Technical Organisation (ETRTO)
		36_9	June 2021	Presentation at the French "Journées Techniques Acoustique et Vibrations" (JTAV2021, 8 June 2021, e-seminar): "Projet LIFE E-VIA : Influence du revêtement de chaussée sur l'émission sonore des véhicules électriques"
		36_10	2021/2022	Praticò F.G., Briante P.G., Colicchio G., Fedele R. Asphalt concretes for electric vehicles. Abstract submitted to: 11th International Conference on the Bearing Capacity of Roads, Railways and Airfields (BCRRA). 29 June - 1 July 2021, Trondheim, Norway.
		36_11	July 2021	Presentation to ICSV27 "THE INTERNATIONAL YEAR OF SOUND: WORLD WILD PROJECTS AND INITIATIVES"
		36_12	July 2021	Presentation to ICSV 27 "THE LIFE E-VIA PROJECT: NOISE CONTROL OF ELECTRIC VEHICLES THROUGH ASSESSMENT AND OPTIMIZATION OF TYRE /ASPHALT INTERACTION"
		36_13	August 2021	Presentation/ paper at the Annual Meeting of the German Acoustical Society: DAGA 2021 - 47. Jahrestagung für Akustik, 15. - 18. August 2021, Vienna.
		36_14	October 2021	Paper submitted to EURONOISE 2021 "Acoustical characterization of low-noise prototype asphalt concretes for electric vehicles"
		36_15	October 2021	Abstract/ presentation submitted to PIARC International Sustainability of Road Transport "LIFE E-VIA: Prototypal low-noise road surface for the reduction of electric vehicle rolling noise in urban area"
		36_16	October 2021	Paper submitted to EURONOISE 2021 "Low-noise road mixtures for electric veichels"
		36_17	March 2022	Presentation/ paper at the Annual Meeting of the German Acoustical Society: DAGA 2022 - 21. – 24. März 2022, Stuttgart,
		36_18	August 2022	Paper submitted to INTERNOISE 2022 "Low-noise friction courses containing treated and un-treated crumb rubber to mitigate tyre/road noise in urban contexts"
19	31/03/2023			Proceedings of Final Event in Florence (USB Keys) -400 copies
	International Congress in Florence	37		

Dissemination Plan – detailed activities 4/4

OTHER DISSEMINATION ACTIVITIES				
20	31/12/2022			Events
		E_1	September 2019	9th international FKL Symposium: The lost sounds rediscovered by the students of the schools that participated in the INAD 2019 initiative
		E_2	January 2021	IYS 2020 Steering Committee Meeting: student competition and Italian events
		E_3	May 2021	Webinar "Mobilità elettrica e asfalti a bassa emissione di rumore: il progetti LIFE E-VIA e altri contributi"
		E_4	October 2021	International Congress in Florence- EXPO MOVE 2021
		E_5	November 2021	Webinar "URBAN HEAT ISLAND AND NOISE: OUR NOT SO INVISIBLE ENEMIES"
		E_6	August 2022	Structured session on "Tyre/road noise" at INTER-NOISE 2022 which will be held August 21–24, 2022, at the Scottish Event Campus (SEC) in Glasgow, U.K..
		E_7	September 2022	Event "Assises Nationales de la Qualité de l'Environnement Sonore"
21	31/12/2022			Six-monthly meetings of the EUROCITIES Environmental Working Groups
		M_1	October 2019	EUROCITIES: Meeting in Oslo during the Environment Forum
		M_2	April 2021	EUROCITIES: Networking activities and information exchanges about LIFE E-VIA project and related activities have been carried out by FIRENZE during the "Environmental forum" held on 28-30 April 2021.
		M_3		
		M_4		
		M_5		
		M_6		

Other activities		
Meeting	September 2019	First meeting among partners
Project kick off meeting	November 2019	LIFE 18 ENV and GIE Welcome meeting in Brussels
Meeting	July 2020	First meeting among partners
Meeting	October 2020	First meeting among partners
Articles	April 2021	Articles published on Italian journals
Meeting	April 2021	Meeting among partners
Lesson to students	June 2021	Lesson to students from the University of Applied Sciences in Hanover

ACTION D2

ACTIVITIES FROM MAY 2021 TO FEBRUARY 2022

LIFE E-VIA

Electric **V**ehicle no**I**se control by **A**ssessment and optimisation of tyre/ road interaction

Dissemination and participation photo album

By Vie en.ro.se. Ingegneria

With the contribution of the LIFE programme of the European Union

LIFE18 ENV/IT/000201

LIFE E-VIA: objectives and actions (DE)

Issued on: May 2021

By: : Continental

Deadline: 31/12/2022

NOTICEBOARD IN GERMAN LANGUAGE

Code: 22_1

LIFE18 ENV/IT/000201

Mit Unterstützung des LIFE-Förderprogramms der Europäischen Union

LIFE E-VIA

Electric **V**ehicle no**I**se control by **A**ssessment and optimisation of tyre/road interaction

Hintergrund

Belastungsdaten der Europäischen Umweltagentur (EEA) zeigen, dass mehr als 100 Millionen EU-Bürger durch gesundheitsbelastende Geräuschpegel beeinträchtigt sind. Laut Weltgesundheitsorganisation (WHO) ist dabei in etwa jede dritte Person in der Europäischen Region Verkehrslärm ausgesetzt, der ungesund ist. 20 % aller Europäer, insbesondere in urbanen Gebieten, sind regelmäßig nächtlichen Schalldruckpegeln ausgesetzt, die gesundheitsschädlich sein können. Wie in der *Noise in Europe Conference* (April 2017) und den WHO Richtlinien (Okt. 2018) ausgeführt wird, müssen EU-Regeln zur Schallquellennormierung auch mit weiteren effektiven Maßnahmen wie Verbesserungen an Straßenoberflächen oder Reifen, und städtebaulichen Maßnahmen kombiniert werden.
Eine Maßnahme, die allgemein als der beste Ansatz zur Geräuschreduzierung und Minimierung gesundheitsschädlicher Luftverschmutzungen im städtischen Umfeld angesehen wird, ist die Einführung der Elektromobilität. Aufgrund der im Vergleich zu klassischen Verbrennungsfahrzeugen geänderten Eigenschaften von Elektrofahrzeugen (EV) gibt es einen Bedarf zur Untersuchung der Reifen-/Fahrbahninteraktion. Weiterhin fehlen, selbst unter Berücksichtigung der Richtlinie 2002/49/EC, entsprechende Koeffizienten, um das CNOSSOS-Model (Richtlinie 996/2015/EC) für die neuen Fahrzeugtypen und Geräuschspektren anwenden zu können.

Ziele

1. Eine Lärmreduzierung für dichtbesiedelte urbane Gebiete durch die Implementierung von Minderungsmaßnahmen die auf **optimierte Straßenbeläge und Reifen für EVs** abzielen. Zwei Straßenoberflächen, mindestens fünf verschiedene Elektrofahrzeuge, ein Referenzfahrzeug mit Verbrennungsmotor und mindestes drei verschiedene Reifen pro Fahrzeugklasse (inkl. spezieller EV-Reifen) werden getestet
2. Eine Abschätzung der **Minderungseffektivität und -potentials** von **Reifen**, **Fahrbahnbelägen** und **Verkehrseigenschaften** (z.B. Verkehrsspektren, Geschwindigkeiten, Fahrweisen) auf einem höheren Verständnisniveau: Lebenszyklus-/Lebenszykluskostenanalyse (**LCA** und **LCCA**) werden durchgeführt um die individuelle und synergetische Effizienz verschiedener Fahrbahnbeläge, Reifen und Fahrzeugen zu zeigen, inkl. eines Vergleichs zwischen reinem Verbrennungs-, Misch- und reinem EV-Verkehr).
3. Beizutragen zur **effektiven Umsetzung von EU-Gesetzgebung** (EU Richtlinien 2002/49/EC und 2015/996/EC) durch die Bereitstellung von speziell für elektrische Fahrzeuge angepasste Rollgeräusch-Koeffizienten für die Common Noise Assessment Methode (**CNOSSOS-EU**). Dies ermöglicht beratenden, planenden und umsetzenden Personen und Organisationen die Betrachtung zukünftiger Szenarien.
4. Beizutragen zur **National-** und **Regionalpolitik** durch die Herausgabe von **Richtlinien** und **Empfehlungen** zur Nutzung und Anwendung der Projektergebnisse. In Kollaboration mit dem Projekt wird beispielsweise durch die regionale Umweltbehörde der Toskana (ARPAT) geschehen. Weitere italienische Kommunen und Regionen haben ebenfalls ihr Interesse bezeugt.
5. Eine **Verbesserung des öffentlichen Bewusstseins** für schädliche Geräuschbelastungen, die daraus resultierenden Gesundheitsgefahren und die damit zusammenhängenden Möglichkeiten der Elektromobilität, mittels zielgerichteter Informationskampagnen und -veranstaltungen, sowie einer Beteiligung der Bevölkerung durch Soundscape-Befragungen und einer der Einbeziehung in die Geräuschdatenerfassung..
6. Das **Demonstrieren** und **Bewerben** eines **nachhaltigen (elektrischen) Straßenverkehrs** durch Reduzierung der Schallbelastung um 5 dB(A) im Bereich der straßenzugewandten Außenfassade bei gleichzeitiger Reduzierung der CO2-Emissionen um 21 % (Werte im Kontext der Gegebenheiten der italienischen Pilotanwendung und des Stands der entsprechenden Literatur)
7. Eine **Förderung** der **Nutzung geräuschoptimierter Straßenoberflächen** in entsprechenden Szenarien **innerhalb** und **außerhalb der EU** durch die Zuschaustellung der Haltbarkeit und Nachhaltigkeit entsprechender Lösungen mittels LCA und LCCA

Maßnahmen

A. Vorbereitende Maßnahmen
A1 Elektrofahrzeuge und ihre Geräuschemissionen
A2 Technologien für leise Fahrbahnbeläge und ihre zeitliche Leistungsfähigkeit
A3 Die Rolles des Reifens im neuen Kontext von Elektro- vs. Verbrennungsfahrzeugen

B. Implementierungsmaßnahmen
B1 Fahrbahnoberflächendesign
B2 Reifen-/Fahrbahninteraktionsstudie und Prototypimplementierung
B3 Pilotanwendung, Implementierung, Replikation und Transferierbarkeit
B4 Fahrbahneffizienztests im Rahmen der Pilotanwendung
B5 Soundscape-Analyse
B6 Auswertung von EV-Geräuschemissionen
B7 Holistische Leistungseigenschaften von Reifen

C. Monitoring der Wirkung der Projektmaßnahmen
C1 Monitoring der Wirkung der Projektmaßnahmen
C2 Lebenszyklusanalyse (LCA) und Lebenszykluskosten (LCC)

D. Öffentliches Bewusstsein und Verbreitung der Ergebnisse
D1 Informations- und Sensibilisierungsmaßnahmen
D2 Verbreitungsmaßnahmen and technische Interessengruppen

E. Projektmanagement

Interessengruppen

Projektwebsite: https://life-evia.eu/

LIFE E-VIA

Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction

4 on 5 noticeboards in German were produced

WEBINAR: ‘Mobilità elettrica e asfalti a bassa emissione di rumore: il progetto LIFE E-VIA e altri contributi’

Issued on: May 2021

By: Comune di Firenze, Vie en.ro.se. Ingegneria, UNIRC

EVENTS
Code: E_3

N° of participants - about 130

Type of participants - about half of them engineers, about 20% acousticians, the rest architects, university researchers and other technicians and employees of administrations/public bodies (in addition to those from co-organisers)

Technical experts in acoustics who received training credits - 34

Authorities involved (among the participants) - Bolzano Province, Como Province, ARPA, Aosta Valley Region among the main ones, as well as several Italian universities

EUROCITIES: ENVIRONMENTAL FORUM
Issued on: April 2021
By: Comune di Firenze

MEETING

Member login

HOME WHO WE ARE HOW WE WORK WHAT WE DO

/ events / events list / EEF: people and planet for the green transition

related issues

air quality circular economy citizens cohesion policy economic development energy efficiency funding & investment governance jobs participation procurement sustainability urban planning water

EEF: people and planet for the green transition (28-30 April)

Tweet

forums	
date	17-03-2021
publication date	17-03-2021
document type	
start date	28-04-2021
end date	30-04-2021

We are delighted to announce the theme of our EEF hosted online by Porto and Guimaraes as "people and planet for a green transition". Join us for three mornings between **28, 29 and 30 April** as we discuss what it means to transition to a healthy and thriving city for all, explore case studies and analyse how we can achieve the status of a thriving city moving forward.

Registrations will open very soon. Watch this space! A hint of what's to come? Oh alright…

Driving the green transition through recovery

Wednesday 28 April @ 09.30-13.30 CET

What does it mean to have a 'green transition'? How can we use recovery strategies to drive the green transition?

Join us as we explore what is means to transition, hold a high-level political debate on driving the transition through recovery and network with our cities to learn how we can localise the European Green Deal through a city showcase (open call – got something to showcase? Get in touch!).

How to enact the green transition locally

Thursday 29 April @ 09.30-12.20 CET

http://members.eurocities.eu/eurocities/calendar/events_list/EEF-people-and-planet-for-the-green-transition-28-30-April-WEBP-BZ7C6B

Paper submitted to AIA Congress
"IL PROGETTO LIFE E-VIA"

Issued on: May 2021

By: Comune di Firenze, Vie en.ro.se. Ingegneria, UNIRC

Deadline: 31/03/2023

SCIENTIFIC PAPERS
Code: 36_7

Associazione Italiana di Acustica
47° Convegno Nazionale
24-28 maggio 2021

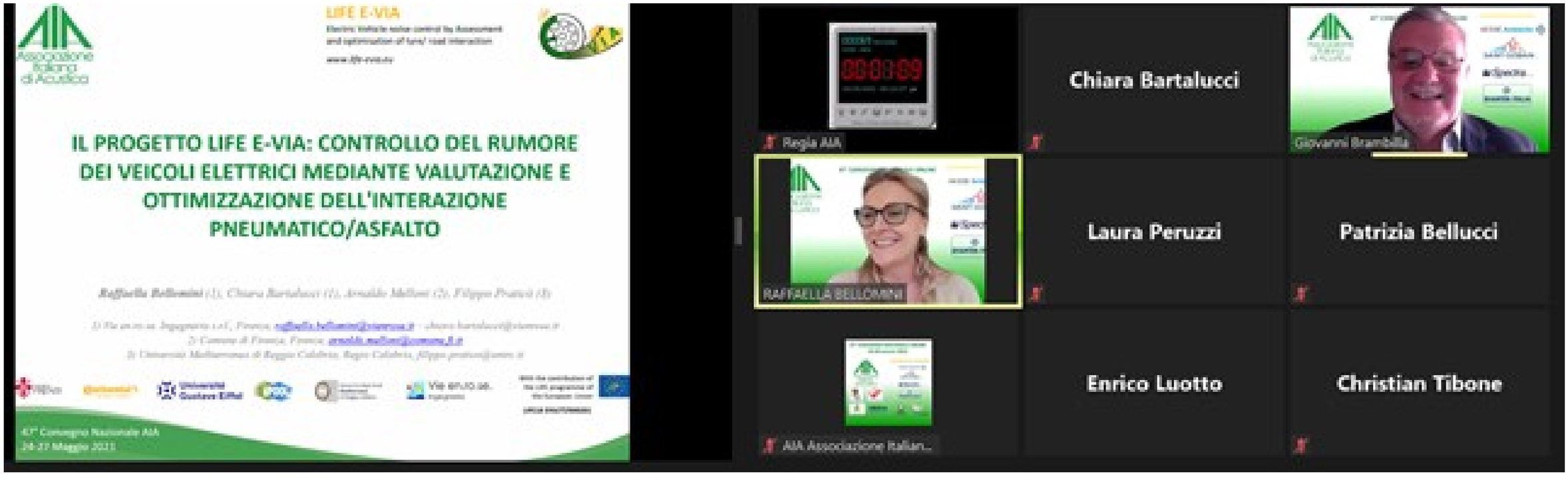
IL PROGETTO LIFE E-VIA: CONTROLLO DEL RUMORE DEI VEICOLI ELETTRICI MEDIANTE VALUTAZIONE E OTTIMIZZAZIONE DELL'INTERAZIONE PNEUMATICO/ASFALTO

Raffaella Bellomini (1), Chiara Bartalucci (1), Arnaldo Melloni (2), Filippo G. Praticò (3)

1) Vie en.ro.se. Ingegneria s.r.l., Firenze, raffaella.bellomini@vienrose.it – chiara.bartalucci@vienrose.it
2) Comune di Firenze, Firenze, arnaldo.melloni@comune.fi.it
3) Università Mediterranea di Reggio Calabria, Regio Calabria, filippo.pratico@unirc.it

SOMMARIO

Il progetto Life E-VIA "Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction", co-finanziato nell'ambito dell'obiettivo prioritario del Programma Life2018 collegato all'inquinamento acustico, affronta la problematica del rumore da traffico stradale, ponendosi in una prospettiva futura in cui i veicoli elettrici e ibridi saranno una parte consistente del traffico stradale e combinando asfalti a bassa rumorosità con pneumatici specifici per i veicoli elettrici.



Presentation of the project to the European Tire and Rim Technical Organisation (ETRTO)

Issued on: May 2021

By: Continental

Deadline: 31/03/2023

SCIENTIFIC PAPERS

Code: 36_8

LIFE E-VIA

Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction

LIFE18 ENV/IT/000201
With the contribution of the LIFE programme of the European Union

Carsten Hoever – Continental Reifen Deutschland GmbH
carsten.hoever@conti.de

Objectives

1. To **reduce noise** for roads inside very populated urban areas through the implementation of a mitigation measure aimed at **optimizing road surfaces and tyres of EVs**.

Objectives

3. To contribute to **EU legislation effective implementation** providing rolling noise coefficients within the Common Noise Assessment Method (**CNOSSOS-EU**), specifically tuned for EVs, aiming at helping to developing **future scenarios.**

Pilot Area Florence

- As a pilot implementation a section of a road in Florence will be paved with the new low-noise road surface.
- The pilot area will be the focus of further actions relating to
  - performance and wear/ageing monitoring of the new surface,
  - LCA/LCAA analysis,
  - Soundscape analysis,
  - …
- The re-pavement of the road will also be linked to an EV festival planned to be held in Florence which shall promote Electric Mobility.

Lesson carried out by CRD to students the University of Applied Sciences in Hanover

Issued on: June 2021

AWARENESS ACTIVITIES

LIFE E-VIA

Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction

LIFE18 ENV/IT/000201
With the contribution of the LIFE programme of the European Union

Carsten Hoever – Continental Reifen Deutschland GmbH
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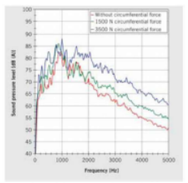
Warum besondere Anforderungen an Reifen und Straße für Elektrofahrzeuge?

Im Vergleich zu Fahrzeugen mit Verbrennungsmotoren...

Akustische Aspekte
Weitere relevante Aspekte

- ...sind EVs schwerer.
  - Höhere Reifenlast → höheres Rollgeräusch.
  - Stärkere Abnutzung von Reifen und Straße.
- ...haben EVs in einem weiten Drehzahlbereich ein höheres Drehmoment.
  - Zusätzliche Rollgeräusch-Anregemechanismen.
  - Stärkere Abnutzung von Reifen und Straße.
- ...gibt es einen nochmals verstärkten Fokus auf niedrigem Rollwiderstand.
  - Niedrigerer Rollwiderstand →höhere Fahrzeugreichweite →höhere Kundenakzeptanz.

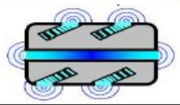


Quelle: F. Stalter et al.: Influence of driving torque on tyre noise, Auto Tech Review 10/2013, 34-38.

Absorbierende Straßenbeläge

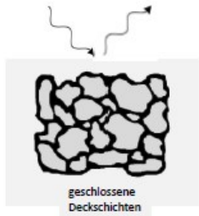
Absorption entlang der Luftschallausbreitung

Minderung von akustischen Resonanzen in der Aufstands-fläche



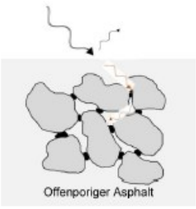
Reduzierung des Horneffektes

Horneffekt: effiziente Abstrahlung aufgrund kontinuierlicher Impedanzanpassung in der Horngeometrie



geschlossene Deckschichten

Auftreffender Schall wird nahezu komplett reflektiert

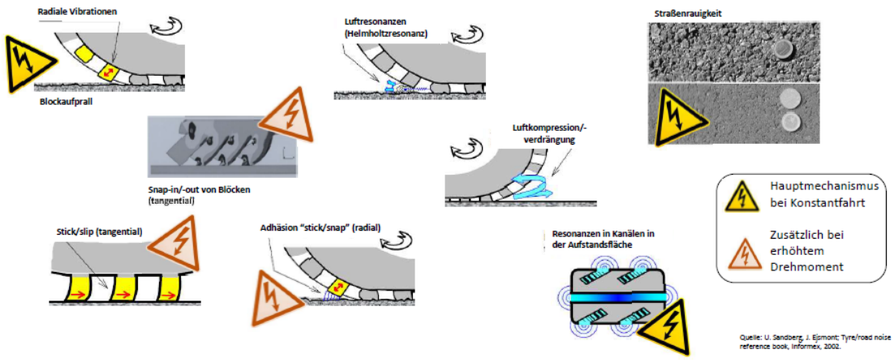


Offenporiger Asphalt

Ein Teil des Schalls dringt in die Deckschicht ein und durch viskose Reibung dissipiert

Nachteile:
- Verstopfung der Poren
- Kürzere mechanische Lebensdauer

Anregungsmechanismen des Reifen-/ Fahrbahngeräusches



Quelle: U. Sandberg, J. Ejsmont: Tyre/road noise reference book, Informex, 2002.

Article published in an open access journal

NOISE MAPPING

Issued on: June 2021

By: Université Gustave Eiffel

Deadline: 31/12/2022

ARTICLE IN A TOP RANKED JOURNAL

Code: 15

Road surface influence on electric vehicle noise emission at urban speed

Julien Cesbron, Simon Bianchetti, Marie-Agnès Pallas, Adrien Le Bellec, Vincent Gary and Philippe Klein

https://doi.org/10.1515/noise-2021-0017

https://doi.org/10.1515/noise-2021-0017

Cite this

DE GRUYTER Noise Mapp. 2021; 8:217–227

Research Article

Julien Cesbron*, Simon Bianchetti, Marie-Agnès Pallas, Adrien Le Bellec, Vincent Gary, and Philippe Klein

Road surface influence on electric vehicle noise emission at urban speed

https://doi.org/10.1515/noise-2021-0017
Received Jan 29, 2021; accepted Apr 23, 2021

Abstract: Considering the relative quietness of electric motors, tyre/road interaction has become the prominent source of noise emission from Electric Vehicles (EVs). This study deals with the potential influence of the road surface on EV noise emission, especially in urban area. A pass-by noise measurement campaign has been carried out on a reference test track, involving six different road surfaces and five electric passenger car models in different vehicle segments. The immunity of sound recordings to background noise was considered with care. The overall and spectral pass-by noise levels have been analysed as a function of the vehicle speed for each couple of road surface and EV model. It was found that the type of EV has few influence on the noise classification of the road surfaces at 50 km/h. However, the noise level difference between the quietest and the loudest road surface depends on the EV model, with an average close to 6 dBA, showing the potential effect of the road surface on noise reduction in the context of growing EV fleet in urban area. The perspective based on an average

the European area, where about 2.5 million of electric passenger cars were in circulation at the end of 2020. This figure comprises battery electric vehicles (BEVs) and plug-in electric vehicles (PHEVs). The market share of new EV registrations over the European area has been reaching 9.4% in 2020 against 3.7% in 2019. Depending on projection scenarios [2], it is expected to reach 15% to 30% of the global vehicle fleet by 2030.

A main advantage of EVs is that there is no exhaust emission while driving in pure electric mode, locally improving air-quality. EVs also contribute to the reduction of CO2 emission in the struggle against global warming [3]. Another key asset of EVs is the relative quietness of electric motors. This leads to the predominance of tyre/road noise from about 20 km/h at steady speed [4, 5]. According to EEA [6], in 2019 at least 20% of the European population was still exposed to noise levels that are considered harmful to human health. This burden is mainly due to road traffic noise, with more than 100 million EU citizens affected by high noise levels exceeding WHO recommendation [7]. Therefore, the development of low emission zones

Journées Techniques Acoustique et Vibrations JTAV 2021

"Projet LIFE E-VIA : Influence du revêtement de chaussée sur l'émission sonore des véhicules électriques"

Issued on: June 2021

By: : Université Gustave Eiffel

Deadline: 31/03/2023

SCIENTIFIC PRESENTATION IN NATIONAL CONGRESS

Code: 36_9

JOURNEES TECHNIQUES ACOUSTIQUE ET VIBRATIONS

JTAV 2021 - SÉMINAIRE DE TRANSFERT COP ▾ ARCHIVES ▾

Accueil (/jtav-2021-seminaire-de-transfert-cop/) / JTAV 2021 - Séminaire de transfert COP (/jtav-2021-seminaire-de-transfert-cop/) / Programme

JTAV 2021 - SÉMINAIRE DE TRANSFERT COP

(/JTAV-2021-SEMINAIRE-DE-TRANSFERT-COP/)

PROGRAMME (/JTAV-2021-SEMINAIRE-DE-TRANSFERT-COP/PROGRAMME/)

ARCHIVES ▾

(/ARCHIVES/JTAV-2020/)

Programme

Lundi 7 juin (séminaire de transfert COP)

- 9h30 - 9h40 Présentation du COP - Axe 3 *J. Lelong (Univ. G. Eiffel/UMRAE)*
- 9h40 - 10h05 Présentation de l'UMRAE *J. Picaut (Univ. G. Eiffel/UMRAE)*
- 10h05 - 10h45 Elaboration de modèles d'émission sonore représentatifs de nouvelles catégories de sources routières *M.-A. Pallas (Univ. G. Eiffel/UMRAE)*
- 10h45 - 11h25 Amélioration des méthodes de caractérisation des émissions de bruit ferroviaire *O. Chiello & M.-A. Pallas (Univ. G. Eiffel/UMRAE)*
- *Pause*
- 13h30 - 14h30 Présentation de NoiseModelling - Utilisation dans le cadre de la recherche
  - Présentation de NoiseModelling et application *P. Aumond (Univ. G. Eiffel/UMRAE)*
  - Couplage Symuvia/MatSim *A. Can @ V. Lebescond (Univ. G. Eiffel/UMRAE)*
  - Nouveaux développements pour la prise en compte des façades végétalisées *B. Gauvreau (Univ. G. Eiffel/UMRAE)*
- 14h30 - 14h50 Présentation de l'outil PLAMADE et couplage avec NoiseModelling *S. Cariou (Cerema/DTecITM) & D. Ecotière (Cerema/DterEst/UMRAE)*
- 14h50 - 15h30 Impact du bruit des avions sur la santé : le projet DEBATS *A.-S. Evrard (Univ. G. Eiffel/UMRESTTE)*
- 15h30 Table ronde *A. Kavaj & M.-C. Bihoreau (DGITM), Ph. Maraval & F. Leray (DGPR), XX (DGAC)*

Mardi 8 juin (JTAV)

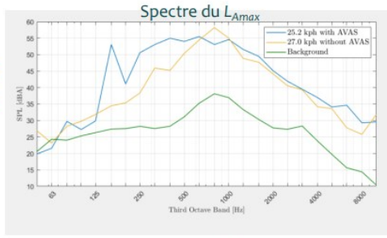
- 9h30 - 9h55 Projet LIFE E-VIA : Influence du revêtement de chaussée sur l'émission sonore des véhicules électriques *J. Cesbron - S. Bianchetti, M.-A. Pallas, A. Le Bellec, V. Gary, Ph. Klein (Univ. G. Eiffel/UMRAE)*
- 9h55 - 10h20 Projet LIFE Cool & Low Noise Asphalt : suivi des performances acoustiques des revêtements de chaussée à faible bruit dans le centre ville de Paris *C. Ribeiro (BruitParif)*
- 10h20 - 10h45 Méthode d'estimation des incertitudes du bruit éolien en conditions favorables à la propagation *B. Kayser (Univ. G. Eiffel/UMRAE)*
- 10h45 - 11h10 Estimation du coefficient d'absorption acoustique moyen par des méthodes de machine learning *C. Foy (Cerema/DterEst/UMRAE) A. Deleforge & D. Di Carlo (INRIA)*
- 11h10 - 11h35 Evaluation environnementale d'une conduite autonome : méthodologie acoustique et vibratoire *Ph. Dunez (Cerema/DterNP/TEER/ABV)*
- *Pause*
- 13h30 -13h55 Création d'une base de données des Points Noirs du Bruit dans les Quartiers Prioritaires du NPNRU *L. Mazouz Cerema/DterNP/TEER/ABV)*
- 13h55 - 14h20 Réseau à grand nombre de microphones et problèmes inverses mis en jeu *Ch. Vanwinsberghe (ISEN Yncréa Ouest)*
- 14h20 - 14h55 Plate-forme expérimentale de mesures acoustiques en temps réel *S. Carra, V. Janillon (Acoucité)*
- 14h55 - 15h20 Prédiagnostic sonore en milieu industriel : développement d'un "kit smartphone" *Isabelle Smith Yamane & A. Alarcon (EDF)*
- 15h20 Questions diverses - clôture des JTAV 2021

Des recherches en cours à l'UMRAE

- **Projet européen LIFE E-VIA (2019-2023) :**
  - **E**lectric **V**ehicle **N**oise Control by **A**ssessment and Optimisation of Tyre/Road Interaction
  - Julien Cesbron et al., Projet LIFE E-VIA : *influence du revêtement de chaussée sur l'émission sonore des véhicules électriques*, JTAV 2021, 8/06/2021
  - https://life-evia.eu/
- **Signal d'alerte AVAS :** caractérisation sous une approche environnementale
  - Comparaison aux niveaux d'émission CNOSSOS-EU / CNOSSOS-FR

Spectre avec AVAS

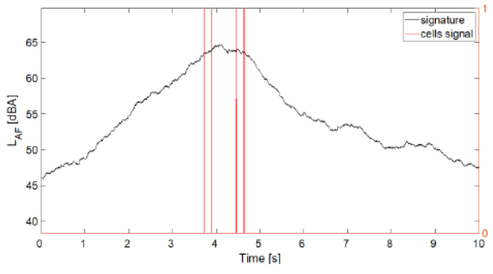
Spectre sans AVAS

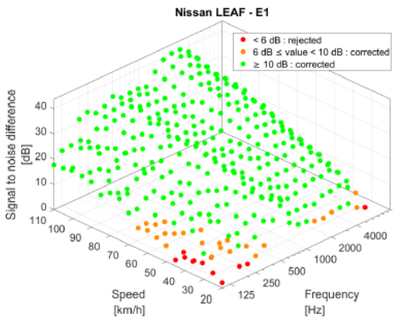


Séminaire COP - Univ. Eiffel 25 7/06/2021

Noise analysis

- L_{Amax} identification from the time signature for each run
- Spectra in 1/3 octave frequency band between 100Hz and 5000Hz
- Correction of background noise level (SNR<6dBA rejected)





JTAV 2021 – Visio-conférence 11 08/06/2021

Video of the prototype construction in Nantes

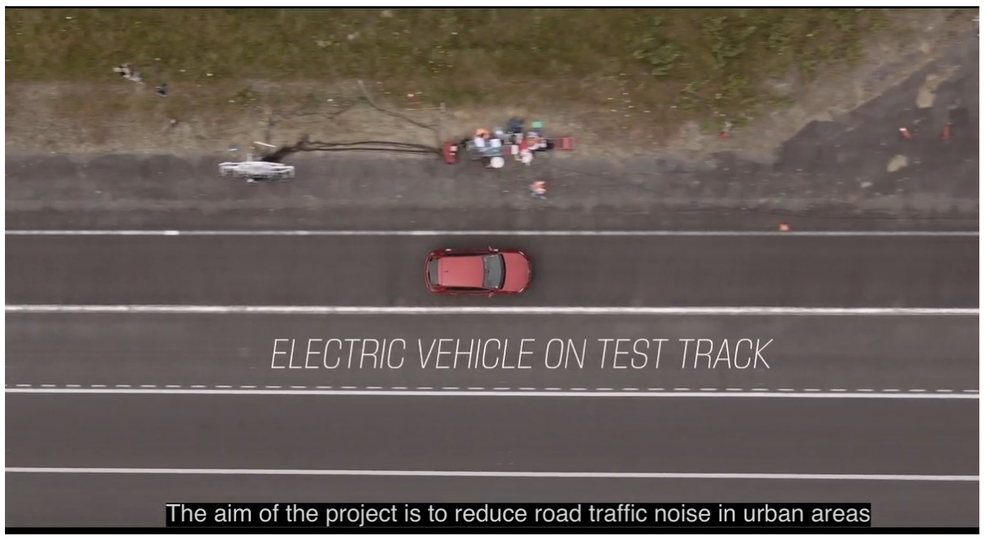
"Low-noise road surface prototype for electric vehicles"

Issued on: June 2021

By: Universitè Gustave Eiffel

Deadline: 31/12/2022

VIDEO OF THE PROTOTYPE CONSTRUCTION
Code: 8



Video available on the official YouTube channel of UMRAE-UniEiffel and on the UMRAE website

Low noise road surface prototype for electric vehicles (EU LIFE E-Via project, LIFE18 ENV/IT/000201) - YouTube

LIFE E-VIA: objectives and actions (FR)

Issued on: July 2021

By: Vie en.ro.se. Ingegneria

Deadline: 31/12/2022

NOTICEBOARD IN FRENCH LANGUAGE

Code: 21_1

LIFE E-VIA

Contrôle du bruit des Véhicules Électriques par l'évaluation et l'optimisation de l'interaction pneumatique/chaussée

Contexte

Les données d'exposition de l'Agence Européenne pour l'Environnement (AEE) montrent que plus de 100 millions de citoyens de l'UE sont affectés par des niveaux de bruit élevés ayant un impact négatif sur la santé de la population. À lui seul, le bruit de la circulation routière est néfaste pour la santé de près d'une personne sur trois en Europe, d'après l'Organisation Mondiale de la Santé (OMS). 20 % des Européens sont régulièrement exposés à des niveaux sonores reconnus susceptibles de nuire considérablement à la santé, en particulier dans les zones urbaines. Comme cela a été mis en évidence lors de la conférence *Noise in Europe* (avril 2017) et dans les recommandations de l'OMS publiées en octobre 2018, le durcissement des normes européennes à la source doit être complété par d'autres mesures efficaces telles que l'amélioration des revêtements routiers-et-des pneumatiques, ainsi que l'aménagement urbain.

L'une des solutions universellement reconnues comme efficaces pour réduire le bruit en milieu urbain, tant en matière de bruit que de qualité de l'air, est l'introduction de la **mobilité électrique**. Ainsi, pour répondre aux nouvelles exigences des véhicules électriques (VE), il est nécessaire d'approfondir les connaissances sur l'interaction pneumatique/chaussée. De plus, pour la mise en œuvre de la directive européenne 2002/49/CE, les coefficients permettant d'appliquer le modèle CNOSSOS (directive 598/2015/CE) aux nouveaux spectres de trafic et aux nouveaux véhicules restent totalement inexistants.

Objectifs

1. **Réduire le bruit** routier au sein des zones urbaines très peuplées par la mise en œuvre d'une solution visant à **optimiser les revêtements routiers et les pneumatiques des véhicules électriques (VE)**. Deux revêtements routiers, au moins 5 modèles de VE, un véhicule à moteur thermique (VMT) de référence et 3 types de pneumatiques (y compris des pneus spécialement conçus pour les VE) seront testés pour chaque technologie de véhicule.
2. Estimer **l'efficacité et le gain potentiel de réduction des pneus, des revêtements et de trafic** (spectre du trafic, vitesses, conditions de conduite) à une échelle plus complète : Une Analyse du Cycle de Vie (**ACV**) et une Analyse du Coût du Cycle de Vie (**ACCV**) seront réalisées pour démontrer l'efficacité respective et synergique des revêtements de chaussées, des pneus et des véhicules (y compris la comparaison entre trafics constitués de véhicules thermiques uniquement, de véhicules électriques ou mixtes).
3. Contribuer à la **mise en œuvre effective de la législation européenne** (directives 2002/49/CE et 2015/996/CE), en fournissant des coefficients de bruit de roulement pour la méthode commune d'évaluation du bruit (**CNOSSOS-EU**), spécifiquement adaptés aux VE, données encore non disponibles pour les professionnels, les organismes et les ministères en charge d'élaborer des scénarios futurs.
4. Contribuer aux **politiques nationales et régionales italiennes**, en publiant des **recommandations** sur l'utilisation et l'application de la méthodologie issue du projet, qui seront adoptées par la Région Toscane, via l'Agenzia Regionale pour l'Environnement de Toscane (ARPAT) soutenant le projet. La Région de Calabre et la ville Reggio de Calabre ont également exprimé leur intérêt.
5. **Sensibiliser** le public à la pollution sonore et aux effets sur la santé en expliquant les possibilités offertes par les véhicules électriques par le biais d'événements de communication et de promotion spécifiques, tout en étudiant la perception des personnes vis-à-vis du bruit sous l'angle méthodologique du paysage sonore et en les impliquant dans l'acquisition de données sur le bruit.
6. Démontrer et promouvoir la **mobilité routière durable (électrique)**, en réduisant les émissions sonores de 3 dB(A) en tout cas et simultanément celles de CO2 (21%), sur la base du scénario Italien (véhicules ZEV, ENC, hybrides, électriques, à essence, diesel) et de la littérature spécialisée.
7. **Encourager la mise en œuvre de revêtements à faible niveau de bruit dans d'autres scénarios européens et extra-européens**, en démontrant leur durabilité et leur pérennité, grâce à une analyse du cycle de vie (ACV) et une évaluation du coût du cycle de vie (CCV) appropriées.

Actions

A. Actions préparatoires
A1 Les véhicules électriques et leurs émissions sonores
A2 Les technologies de chaussées peu bruyantes et la pérennité de leurs performances
A3 Le rôle du pneumatique dans le nouveau contexte des VE et des VMT

B. Actions de mise en œuvre
B1 Conception de la formulation du revêtement de chaussée
B2 Étude du couplage pneumatique-chaussée et réalisation du prototype
B3 Zone pilote : Mise en œuvre, Reproductibilité et Isonéabilité
B4 Tests d'efficacité des voies dans la zone pilote
B5 Analyse du paysage sonore
B6 Évaluation des émissions sonores des VE
B7 Performance holistique des pneumatiques

C. Suivi de l'impact des actions du projet
C1 Suivi de l'impact des actions du projet
C2 Analyse du cycle de vie (ACV) et coût du cycle de vie (CCV)

D. Sensibilisation du public et diffusion des résultats
D1 Activités d'information et de sensibilisation
D2 Activités de diffusion technique auprès des parties prenantes

E. Gestion du projet

PARTIES PRENANTES

Site web du projet: https://life-evia.eu/

LIFE E-VIA

Electric Vehicle noise control by Assessment and optimisation of tyre/road interaction

3 on 5 noticeboards in French were produced, 1 is in production

Articles published on Italian journals

Issued on: July 2021

> 30 articles published

NETWORKING ACTIVITIES

MP

Bimestrale

Data 07-2021
Pagina 74
Foglio 1

PROGETTI EUROPEI LIFE NEREIDE E LIFE E-VIA

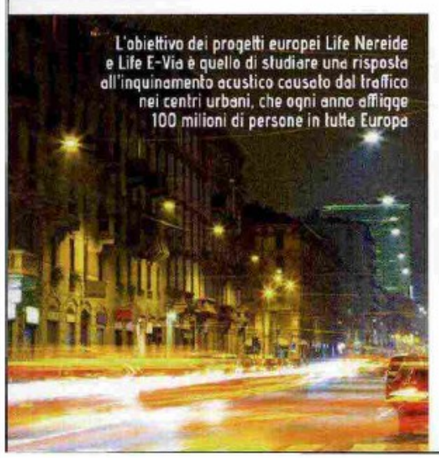
Asfalti con materiali riciclati contro l'inquinamento acustico e a favore della mobilità elettrica

In Italia sono in corso due progetti europei, Life Nereide e Life E-Via, che intendono proporre soluzioni contro l'inquinamento acustico: uno dei problemi ambientali che toccano maggiormente la salute e la qualità della vita della popolazione europea. L'Agenzia Europea dell'Ambiente (EEA) stima infatti che siano oltre 100 milioni i cittadini europei esposti in maniera prolungata a livelli di rumore eccessivi e che, per questo, rischino conseguenze anche gravi per la salute. Stima inoltre che l'inquinamento acustico stradale notturno, ancora più dannoso per la salute, colpisca almeno il 20% della popolazione europea che vive nelle aree urbane.

Alcune tra le azioni più efficaci introdotte per risolvere questo problema riguardano la realizzazione di pavimentazioni stradali a bassa emissione sonora, ottenute anche con materiali di riciclo, e la progressiva diffusione della mobilità elettrica. Nati per analizzare i benefici possibili derivanti da tali soluzioni, Life Nereide e Life E-Via sono due progetti finanziati dal programma Life, volto a sostenere azioni a favore dell'ambiente e del clima.

Il progetto Life Nereide, che si sta avviando alla conclusione, ha portato alla definizione delle migliori soluzioni per realizzare pavimentazioni estremamente silenziose e sostenibili, capaci di ridurre il rumore del traffico fino a 5 dB grazie a un uso intelligente di materiali quali il polverino di gomma riciclata e il fresato d'asfalto, ottenuto dalla rimozione di vecchie pavimentazioni. Il progetto è guidato dal Dipartimento d'Ingegneria Civile e Industriale dell'Università di Pisa e vede come partner la Regione Toscana e l'agenzia regionale Arpat, il centro di ricerca belga BRRC, l'Idasc-CNR e il consorzio Ecopneus. Grazie al progetto sono state definite 12 differenti mescole bituminose, posate su diverse strade della Toscana; sono state poi effettuate misurazioni acustiche sulle pavimentazioni e indagini sulla popolazione, per conoscere gli effetti concreti su chi vive nei pressi di strade a elevato scorrimento.

Dal canto suo, il progetto Life E-Via si sta invece concentrando sui veicoli elettrici e ibridi, studiandone l'interazione pneumatico-strada per individuare e implementare misure di mitigazione del rumore attraverso l'ottimizzazione sia degli pneumatici sia del fondo stradale, anche attraverso lo sviluppo di un nuovo asfalto "silenzioso" messo a punto grazie a un approccio simile a quello adottato da Life Nereide. Il progetto vede coinvolti il Comune di Firenze, in qualità di coordinatore, e i partner: Continental, iPool, Università Gustave Eiffel, Università degli Studi di Mediterranea di Reggio Calabria e Vie En.Ro.Se. Ingegneria.



L'obiettivo dei progetti europei Life Nereide e Life E-Via è quello di studiare una risposta all'inquinamento acustico causato dal traffico nei centri urbani, che ogni anno affligge 100 milioni di persone in tutta Europa

DATA STAMPA
www.datastampa.it

LA NAZIONE FIRENZE
Dir. Resp.: Agnese Pini
Tiratura: N.D. Diffusione: 19762 Lettori: 120000 (0005822)

15-LUG-2021
da pag. 1-9 /
foglio 2 / 2

IN VIA PAISIELLO

Arriva l'asfalto anti rumore

Sono iniziati ieri i lavori di asfaltatura in via Paisiello. Non si tratta di semplice bitume, ma di un nuovo asfalto anti rumore che viene sperimentato proprio a Firenze. Un materiale, che permette una riduzione delle emissioni rumorose prodotte dalle auto e rientra nel progetto Life E-Via, che vede Firenze città capofila. I lavori proseguiranno fino a venerdì con restringimenti di carreggiata su via Paisiello tra via Rinuccini e via Lagorio e chiusure delle traverse laterali. «**Grazie** a questo progetto – hanno detto l'assessore all'Ambiente Cecilia Del Re e l'assessore alla Mobilità Stefano Giorgetti – possiamo contribuire a ridurre l'inquinamento acustico nelle aree urbane». L'obiettivo è quello di ottimizzare asfalti e pneumatici per ridurre il rumore. Il Progetto, co-finanziato dall'Unione europea ha avuto inizio a luglio 2019 e terminerà a gennaio 2023.

Un passo avanti per la costruzione del sistema tramviario dell'area metropolitana

Report INAD Italia 2020-2021 (ITA)

Issued on: July 2021

By: Vie en.ro.se. Ingegneria

Deadline: 31/12/2022

REPORT ON YEARLY PARTICIPATION IN INAD

Code: 25_1

Associazione Italiana di Acustica

INTERNATIONAL

NOISE AWARENESS DAY

INAD Italia 2020-21

"AscoltiAMO i suoni"

Report finale

É stata inoltre svolta una intensa comunicazione sui social network e attraverso contatti diretti con molte redazioni giornalistiche, con scuole musicali e conservatori italiani.

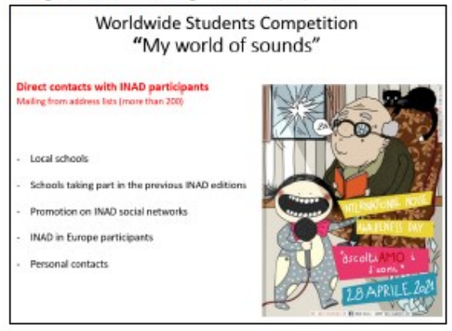
LIFE E-VIA project (LIFE18 ENV/IT/000201): il progetto, finanziato dall'Unione Europea, si concentra sulle potenzialità di utilizzo dei veicoli elettrici ed ibridi, che in futuro avranno un ruolo importante nel mercato automobilistico. Il progetto studia l'interazione pneumatico-strada per individuare ed implementare misure di mitigazione del rumore, attraverso l'ottimizzazione sia degli pneumatici dei veicoli elettrici sia del fondo stradale. Inoltre il progetto prevede un'intensa attività di disseminazione e sensibilizzazione sul tema del rumore, organizzando anche attività negli istituti scolastici, in accordo e in collaborazione anche con l'attività portate avanti nelle diverse Nazioni dei partner del Progetto (Italia, Francia e Germania) nell'ambito di INAD.

L'evento è stato diffuso principalmente attraverso i seguenti canali:

CONVEGNI:

- Convegno Nazionale AIA – Online 24-28/05/2021

- IYS 2020-2021 Steering Committee Meeting – Online 16/01/ 2021



WEB:

- siti internet di: Associazione Italiana di Acustica, EAA, Documenta Acustica, IYS 2020-21
- siti internet delle scuole e degli Enti partecipanti.

SOCIAL NETWORK:

- pagina facebook: INAD Italia;
- gruppo facebook: Noise Awareness Day Italia;
- pagina facebook: Intenational Year of Sound.

https://acustica-aia.it/inad/#1579087438323-0-39cf2-c675844d-d32b

Abstract submitted to BCRRA conference
“Asphalt concretes for electric vehicles”

Issued on: June 2021

By: UNIRC

Deadline: 31/03/2023

SCIENTIFIC PAPERS
Code: 36_10

Abstract submitted to 11th International Conference on the Bearing Capacity of Roads, Railways and Airfields (BCRRA).

Authors*: Praticò F.G., Briante P.G., Colicchio G., Fedele R.*

Abstract: The interaction among electric vehicles (EVs) and road pavements affects road performance in a different way with respect to internal combustion engine vehicles (ICEVs). Consequently, the design of asphalt concrete road pavements for EVs should take into account both functional and mechanistic characteristics. In particular, porosity, resistivity, tortuosity and thickness should be considered to estimate the acoustic absorption, while surface texture should be measured to characterize road pavements consisting in both traditional and recycled materials. Unfortunately, there is still lack of methods to consider both functional and mechanistic characteristics for EVs. Based on the above, the main objective of the study here presented is to set up and apply a method to predict the acoustic and mechanistic performance of road pavements to face EV-related problems. GAP graded and Dense graded (i.e., GAP – AC6o, and DGFC – AC6d) mixtures, with different crumb rubber percentages, were produced using the gyratory compactor. Consequently, experimental investigations were carried out to derive acoustic and mechanic properties (including acoustic absorption, airflow resistivity, skid resistance, permeability, and surface texture.
Finally, the prediction model was set up and validated using the experimental results. Results show that the proposed model is helpful in selecting and ranking bituminous mixtures based on requirements.

Keywords: Electric vehicle, Road Pavement, Acoustic Absorption, Airflow resistivity, Recycled materials.

Paper submitted to BCRRA2021 will be presented the next year at BCRRA 2022.

Paper submitted to ICSV27 “THE INTERNATIONAL YEAR OF SOUND: WORLD WILD PROJECTS AND INITIATIVES”

Issued on: July 2021

By: Vie en.ro.se. Ingegneria

Deadline: 31/03/2023

SCIENTIFIC PAPERS
Code: 36_11

27th International Congress on Sound and Vibration
The annual congress of the International Institute of Acoustics and Vibration (IIAV)
11-16 July, 2021
ICSV27
Annual Congress of the International Institute of Acoustics and Vibration (IIAV)

THE INTERNATIONAL YEAR OF SOUND: WORLDWIDE PROJECTS AND INITIATIVES

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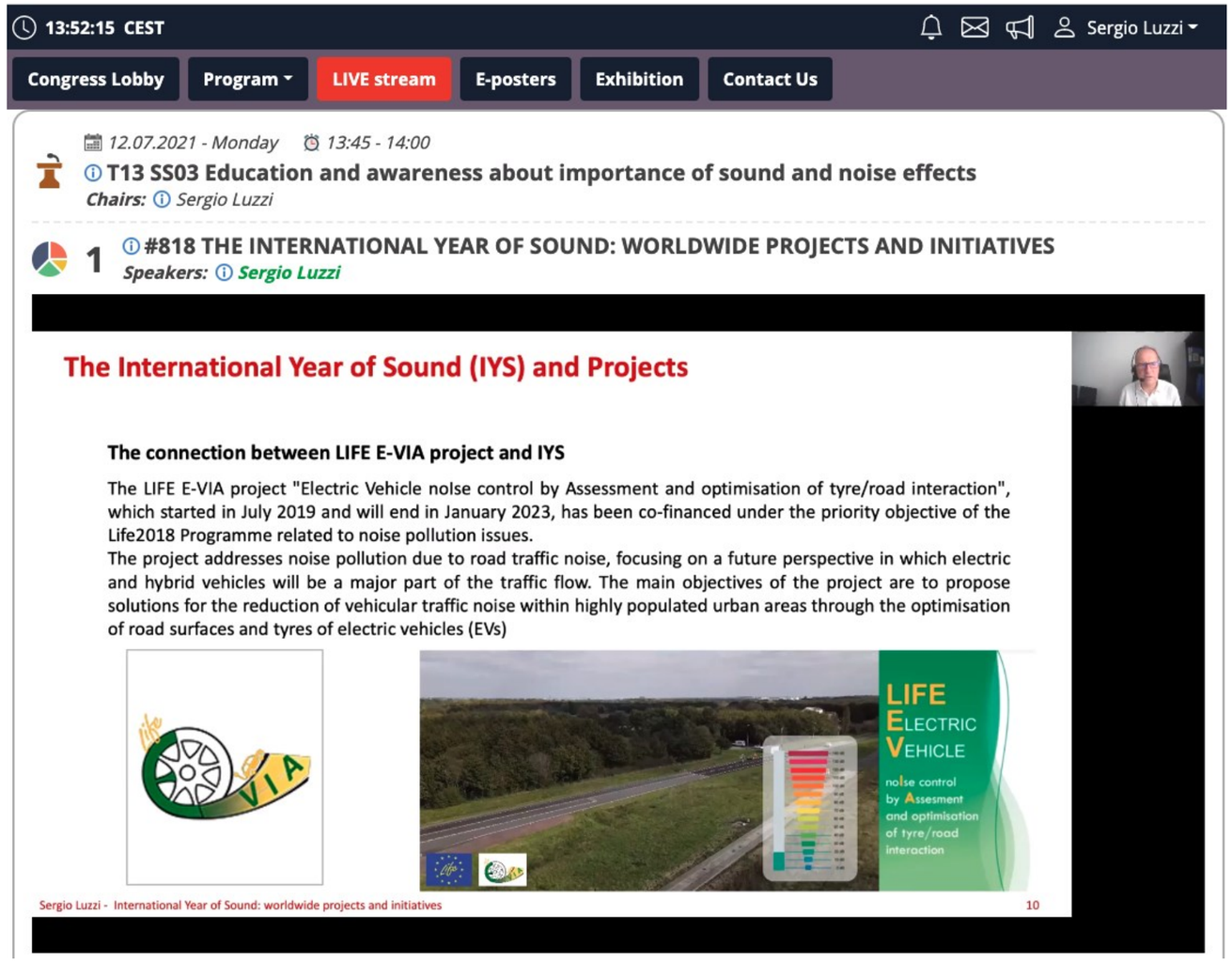
Sound plays an important role in the enjoyment of landscapes as well as in all human activities included education and it is also an essential part of communication between humans, in the form of speech and listening, creative sounds and music. The International Year of Sound (IYS) is a global initiative under the UNESCO Charter of Sound No. 39C/59. Its purpose is to highlight the importance of sound and the related sciences and technologies in the society and the world, considering landscape aspects and noise control in nature, in the built environment and in workplaces. IYS 2020-21 includes activities organized at the regional, national and international level by the International Commission for Acoustics (ICA). Among them there is a competition for students from around the world on the theme of "My World of Sounds". In particular, primary and middle school students are asked to produce drawings, images, patchwork, collages and similar related to their world of sounds, while high school students are asked to write a verse of the song entitled "We are the sounds of our world", inspired by the melody and refrain of the latter. Moreover, several events such as conferences, seminars, workshops but also performances, exhibitions had been included in the program of national IYS initiatives, as long as they are consistent with the message of the initiative. Due to the spread of the Covid-19 pandemic, only few initiatives took place, nevertheless some international projects have been carried on. In this paper a general updated overview on activities organised in the frame of the IYS is given and the state of implementation of some projects connected with IYS are shown.

Keywords: International Year of Sound, UNESCO, worldwide activities, LIFE projects



Paper submitted to ICSV27
"THE LIFE E-VIA PROJECT"

Issued on: July 2021

By: Comune di Firenze, Vie en.ro.se. Ingegneria

Deadline: 31/03/2023

SCIENTIFIC PAPERS
Code: 36_12

27th International Congress on Sound and Vibration
The annual congress of the International Institute of Acoustics and Vibration (IIAV)
11-16 July, 2021
ICSV27

Annual Congress of the International Institute of Acoustics and Vibration (IIAV)

THE LIFE E-VIA PROJECT: NOISE CONTROL OF ELECTRIC VEHICLES THROUGH ASSESSMENT AND OPTIMISATION OF TYRE/ASPHALT INTERACTION

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European Environment Agency (EEA) data shows that some 100 million EU citizens are affected by high noise levels, negatively impacting their health. Traffic noise alone is harmful to the health of 40 million EU citizens of which 8 million are regularly exposed to high traffic noise level at night. European policies to reduce environmental noise, and in particular road traffic noise, in densely populated cities are focused on the introduction of low-noise asphalts and a progressive increase in the use of electric vehicles. The LIFE E-VIA "Electric Vehicle noIse control by Assessment and optimization of tyre/road interaction" project, co-funded under the priority objective of the Life2018 Programme related to noise pollution, addresses the issue of road traffic noise. Specifically, it looks ahead to a future where electric and hybrid vehicles will be a major part of road traffic and combining low-noise asphalts with tyres specifically for electric vehicles. The LIFE E-VIA project, started in July 2019 with a foreseen duration of 42 months, will foster the application of Directive 2002/49/EC on the assessment and management of environmental noise and of Directive 996/2015/EC on establishing common noise assessment methods (CNOSSOS model), in the context of the promotion and use of electric vehicles (EVs) and hybrid vehicles. The project will seek to develop a solution to reduce the rolling noise of electric and hybrid vehicle tyres in urban areas, taking account of the current best practices, also addressing the soundscape analysis and citizens involvement.
In the present article, after an introduction on the future policies for the reduction of road traffic noise in Europe, the objectives of the LIFE E-VIA project and its methodology are described, demonstrating how the expected results are in line with European strategies. Finally, recent preliminary results achieved by some key actions of the project are mentioned.

Keywords: Rolling noise, electric vehicles, EU policies.

Presentation/ paper at the
DAGA 2021 - 47. Jahrestagung für Akustik

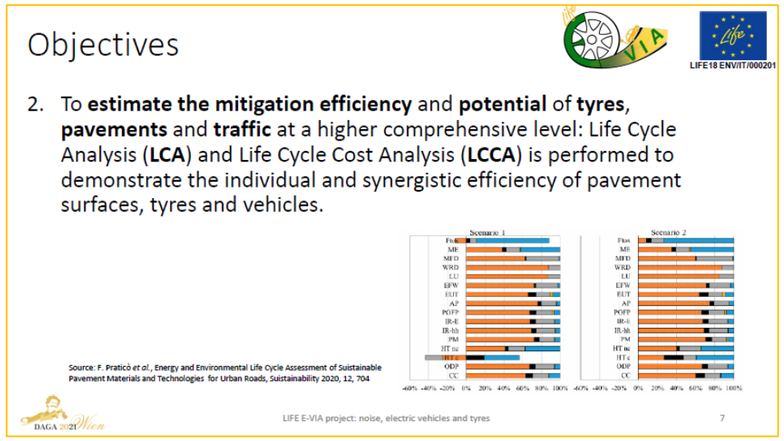
Issued on: August 2021

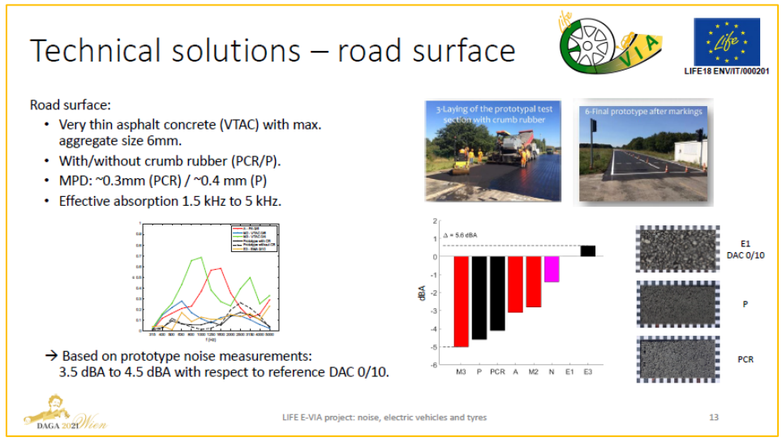
By: CONTINENTAL

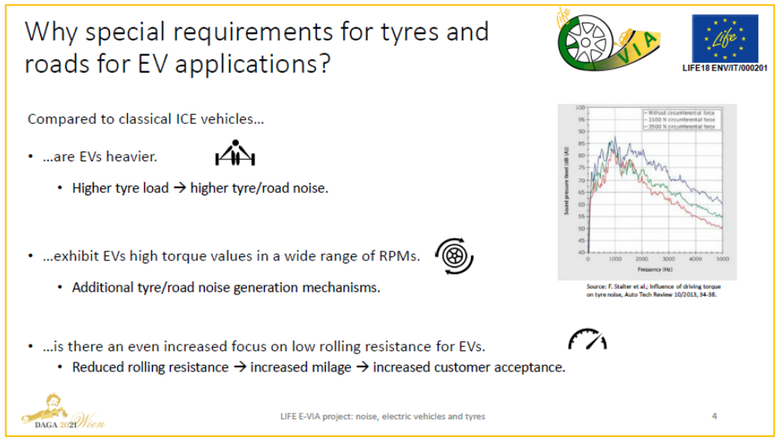
Deadline: 31/03/2023

SCIENTIFIC PAPERS

Code: 36_13







LIFE E-VIA: the pilot case (IT)

Issued on: September 2021

By: Vie en.ro.se. Ingegneria

Deadline: 31/12/2022

NOTICEBOARD IN ITALIAN LANGUAGE

Code: 23_2

LIFE18 ENV/IT/000201

With the contribution of the LIFE programme of the European Union

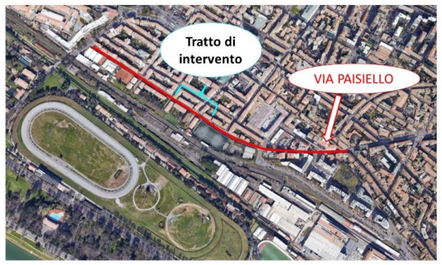
LIFE E-VIA

Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction

Il caso pilota

Dopo una fase progettuale seguita da una serie di accurati esperimenti di laboratorio, sono state selezionate due miscele di asfalto che sono state testate, durante il passaggio di veicoli elettrici, presso l'area di sperimentazione a Nantes. Al termine delle misure svolte in Francia, è stata scelta la miscela più efficace, contenente polverino di gomma da pneumatici riciclati. Quest'ultima è stata utilizzata presso il caso pilota individuato nella Città di Firenze, al fine di analizzare il beneficio apportato in termini di abbattimento del rumore da traffico veicolare. L'area pilota è stata identificata in Via Paisiello, caratterizzata da una significativa densità di abitazione. Il tratto di strada interessato dall'intervento è rettilineo e a senso unico di marcia. Inoltre, l'area pilota è caratterizzata da un elevato flusso di traffico dovuto alla vicinanza con il centro e alla presenza di uffici pubblici. Nelle vicinanze si trovano, inoltre, un importante parco pubblico (Cascine), interventi di riqualificazione urbana (Ex. Manifattura Tabacchi) e vari servizi pubblici, quali scuole, esercizi commerciali, impianti sportivi.

Inquadramento Stato ante operam



Lavori di asfaltatura

Rimozione asfalto

Stesura nuovo asfalto

Verifiche della tessitura

Stato post operam

Sito web: https://life-evia.eu/

4 on 5 noticeboards in Italian were produced

LIFE E-VIA: the pilot case (EN)

Issued on: September 2021

By: Vie en.ro.se. Ingegneria

Deadline: 31/12/2022

NOTICEBOARD IN ENGLISH LANGUAGE

Code: 18_3

LIFE18 ENV/IT/000201

With the contribution of the LIFE programme of the European Union

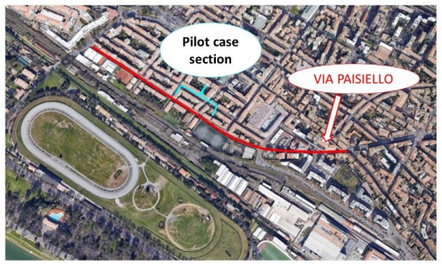
LIFE E-VIA

Electric **V**ehicle no**I**se control by **A**ssessment and optimisation of tyre/road interaction

The Pilot case

After an initial designing stage followed by careful laboratory experiments, two different asphalt mixtures have been selected and tested in the experimental area in Nantes, during the electric vehicles passages. The measurements carried out in France allowed to choose the most efficient mixture. This asphalt mixture contains crumb rubber from recycled tyres and it has been used in the pilot case in Firenze in order to analyse the benefits it provides to reduce traffic noise. Via Paisiello has been selected as a pilot area. It is characterized by a significant housing density. The section of the street where the asphalting works have been carried out, is straight and one-way. Moreover, the pilot area is characterized by a high level of traffic caused to its proximity to the city center and the presence of public offices. In the neighbourhood there are also an important public park (Cascine), urban regeneration interventions (Ex. Manifattura Tabacchi) and several public services, such as schools, commercial activities and sport installations.

Ante operam status



Asphalting works

Asphalt removal

Laying a new asphalt

Texture check

Post operam status

Sito web: https://life-evia.eu/

5 on 15 noticeboards in English were produced

LIFE E-VIA: the pilot case (FR)

Issued on: September 2021

By: Université Gustave Eiffel

Deadline: 31/12/2022

NOTICEBOARD IN FRENCH LANGUAGE

Code: 21_2

LIFE E-VIA

Contrôle du bruit des Véhicules Électriques par l'évaluation et l'optimisation de l'interaction pneumatique/chaussée

LIFE18 ENVIT/000201

Le projet pilote

Après une première phase de conception suivie d'expériences en laboratoire détaillées, deux enrobés ont été sélectionnés et testés sur la zone expérimentale de Nantes, au passage de véhicules électriques. Les mesures effectuées en France ont permis d'identifier le mélange le plus performant. Cette formule de béton bitumineux contient de la gomme provenant de pneus recyclés et a été utilisée dans le projet pilote à Florence afin d'analyser les avantages en matière de réduction du bruit de trafic. La rue Paisiello a été sélectionnée comme zone pilote. Elle se caractérise par une forte densité de logements. La section où les travaux de pose du béton bitumineux ont été réalisés est rectiligne et à sens unique. De plus, elle présente un niveau élevé de trafic dû à la proximité du centre ville et à la présence d'établissements publics. Dans le quartier, on trouve également un important parc public (Cascine), des opérations de réhabilitation urbaine (Ex. Manifattura Tabacchi) et divers établissements publics, tels que des écoles, des activités commerciales et des installations sportives.

État initial

Mise en œuvre du nouvel enrobé bitumineux

Élimination de l'ancien revêtement routier

Pose du nouveau béton bitumineux

Contrôle de la texture

État final

Site web: https://life-evia.eu/

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LIFE E-VIA

Electric Vehicle noise control by Assessment and optimisation of tyre/road interaction

LIFE E-VIA: the pilot case (DE)

Issued on: September 2021

By: CONTINENTAL

Deadline: 31/12/2022

NOTICEBOARD IN GERMAN LANGUAGE

Code: 22_2

LIFE E-VIA

Electric Vehicle noise control by Assessment and optimisation of tyre/road interaction

LIFE18 ENV/IT/000201

Die Pilot-anwendung

Als Ergebnis einer initialen Designphase gefolgt von umfassenden Laborexperimenten wurden zwei Asphaltmischungen ausgewählt und auf einer Teststrecke in Nantes mittels Geräuschmessungen für Vorbeifahrten von Elektrofahrzeugen getestet. Auf Basis dieser Ergebnisse konnte die bessere der beiden Mischungen identifiziert werden. Diese enthält als Besonderheit Gummigranulat von Altreifen. Im Rahmen einer Pilotanwendung wurde in Florenz ein Abschnitt einer Straße mit der ausgewählten Mischung asphaltiert, um das Potential zur Verringerung des Straßenverkehrslärms zu untersuchen. Bei der ausgewählten Via Paisiello handelt es sich um eine Einbahnstraße, die im Bereich der Neuasphaltierung gerade verläuft. Die Umgebung ist aufgrund ihrer Nähe zum Stadtzentrum durch eine hohe Wohndichte und ein hohes Verkehrsaufkommen gekennzeichnet. In der Nachbarschaft gibt es weiterhin einen bedeutenden öffentlichen Park (*Cascine*), Stadterneuerungsprojekte (z.B. *Manifatura Tabacchi*), Geschäfte und öffentliche Einrichtungen wie Schulen und Sportanlagen.

Ausgangs-situation

Asphaltier-arbeiten

Entfernung des Altbelages

Neuasphaltierung

Überprüfung der Oberflächenrauigkeit

Ergebnis

Webseite: https://life-evia.eu/

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LIFE E-VIA

Electric Vehicle noise control by Assessment and optimisation of tyre/road interaction

LIFE E-VIA: Laboratory experiments(EN)

Issued on: September 2021

By: UNIRC

Deadline: 31/12/2022

NOTICEBOARD IN ENGLISH LANGUAGE

Code: 18_4

LIFE E-VIA

Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction

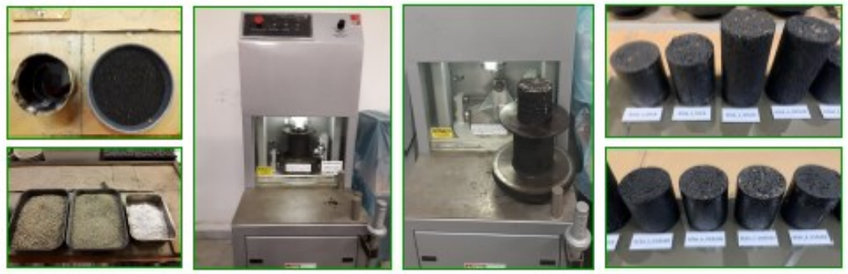
LIFE18 ENV/IT/000201

With the contribution of the LIFE programme of the European Union

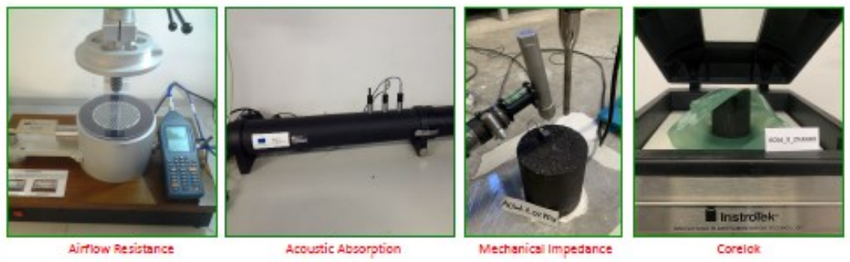
Mix design

The University 'MEDITERRANEA' of Reggio Calabria (UNIRC) analysed more than 150 solutions in the literature (friction courses), based on acoustic and non-acoustic performance, in order to select appropriate solutions. Their characteristics and impacts were considered and preliminary tests were carried out. From 150 asphalt concretes, nine mixtures were selected, based on many characteristics, including: 1) Acoustic response. 2) Expected life by referring to mechanistic properties. 3) Permeability. 4) Friction. 5) ENDT value.
Based on these latter, open asphalt concretes with Nominal Maximum Aggregate of 6 mm (AC6) were selected.
An accurate plan of experiments was set up and followed in order to design and validate the final mixtures. Two types of mixtures were finally designed and tested (AC6 with and without crumb rubber).

Superpave compaction



Laboratory experiments



Airflow Resistance | Acoustic Absorption | Mechanical Impedance | Corelok

Permeability | Skid Test | Sand Patch Test | Marshall Stability

Sito web: https://life-evia.eu/

LIFE E-VIA

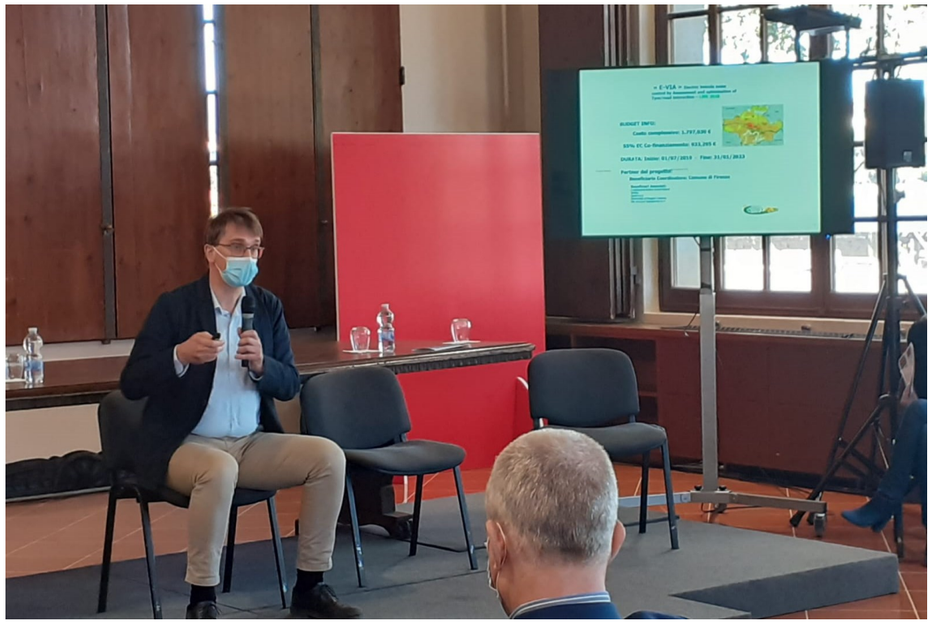
Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction

EXPOMOVE21 'Conferenza internazionale mobilità sostenibile: uno sguardo europeo'

Issued on: October 2021

By: Comune di Firenze, Vie en.ro.se. Ingegneria, UNIRC

EVENTS
Code: E_4



LIFE E-VIA: Leaflet (EN)

Issued on: October 2021

By: Vie en.ro.se. Ingegneria

ADDITIONAL DOCUMENT

Objectives of the LIFE E-VIA project

1. To reduce noise for roads inside very populated urban areas through the implementation of a mitigation measure aimed at optimizing road surfaces and tyres of EVs.
2. To estimate the mitigation efficiency and potential of tyres, pavements and traffic (traffic spectrum, speeds, handling conditions) at a higher and comprehensive level.
3. To contribute to EU legislation effective implementation (EU Directives 2002/49/EC and 2015/996/EC), providing rolling noise coefficients within the Common Noise Assessment Method (CNOSSOS-EU).
4. To contribute to national and Italian regional policies, issuing guidelines about use and application of the methodology output of the project.
5. To raise people's awareness of noise pollution and health effects.
6. To demonstrate and promote sustainable road transport mobility (electric), reducing noise emission by 5 dB(A) at receivers' roadside and achieving also CO_2 emissions reduction.
7. To encourage low-noise surfaces implementation in further EU and extra-EU scenarios.

LIFE18 ENV/IT/000201

www.life-evia.eu

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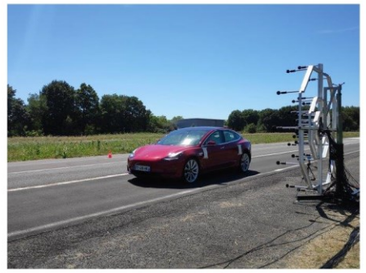


LIFE E-VIA

Electric Vehicle noIse control by Assessment and optimisation of tyre/ road interaction

With the contribution of the LIFE programme of the European Union

ExpoMove 21-22 edition

13th - 14th October 2021, Florence

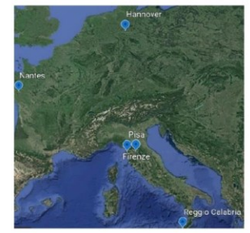
Backgroud

Which are the solutions to reduce noise in our cities? Are electric vehicles totally silent? How citizens can be involved in proactive good practices for noise reduction? These are some of the questions that the European LIFE E-VIA project aims to answer in depth.

Exposure data from the European Environment Agency demonstrate that more than 100 million EU citizens are affected by high noise levels negatively impacting human health. Traffic noise alone is harmful to the health of almost every third person in the World Health Organization European Region. 20% of Europeans are regularly exposed to night sound levels that could significantly damage health, especially in urban areas. The introduction of electric mobility is widely viewed as having the potential to reduce noise in urban areas, but the noise generated by tyres rolling on the road nevertheless needs careful study and further reduction.

Whitin this context, the project intends to:

- tackle noise pollution from road traffic noise focusing on a future perspective in which electric and hybrid vehicles will be a consistent portion of the flow;
- combine knowledge of road optimization and tyre development in order to test an optimized solution for reducing noise in urban areas and Life Cycle Cost with respect to actual best practices.



Actions

LIFE E-VIA started in July 2019 and will end in January 2023. The project is coordinated by the Municipality of Firenze and involves as partners the Mediterranean University of Reggio Calabria, Continental, Vie en.ro.se Ingegneria, University Gustave Eiffel and I-POOL. Specifically, the project has:

- built in Nantes a test road surface designed for the specific context of electric vehicles (EVs) and their tyres. Different EV types have been tested on this surface, with different tyre types per vehicle, to identify the optimal combination for noise reduction. An internal combustion engine vehicle has been used as reference;
- carried out further testing in a pilot area in Florence (Via Paisiello), with the construction of two road surfaces, an optimised and a reference one.

On-going activities:

- estimation of the noise mitigation efficiency and potential of tyres, road surfaces and traffic through a life-cycle and a life-cycle cost analysis;
- calculation of rolling noise coefficients according to the EU CNOSSOS model for the EV fleet in order to define guidelines on the application of the project's results;
- involvement of citizens through targeted information initiatives on electric and sustainable mobility and through soundwalks and interviews.

LIFE HEATLAND PROJECT WORKSHOP "URBAN HEAT ISLAND AND NOISE: OUR NOT SO INVISIBLE ENEMIES"

Issued on: November 2021

By: Comune di Firenze

EVENTS
Code: E_5

HEATLAND

URBAN HEAT ISLAND AND NOISE: OUR NOT SO INVISIBLE ENEMIES

17th November 2021 17:00h CET - Online

17:00 Welcome.

Vladimir Gumilar. Director at Construction Cluster of Slovenia.

17:10 Cool Pavements for Future Cities. Bye Bye Heat & Noise. **LIFE HEATLAND** project.

Francisco Miguel Moral. Head of Energy and Insulation Area, CTCON.

17:30 Fight against noise and heat in the city. **LIFE COOL & LOW NOISE IMPACT** project.

Giulia Custodi. Environmental Health Impact Division, Paris City Council.

Mailys Chanial. Paris City Hall, Water and Sanitation &. Roads and Traffic Divisions.

18:00 Reducing noise for roads inside very populated urban areas. **LIFE E-VIA** project.

Arnaldo Melloni. Environmental Management, Municipality of Florence.

18:30 Cool pavement technology in Arizona. **CITY OF PHOENIX COOL PAVEMENT** Program.

Ryan Stevens. PE, Civil Engineer III, City of Phoenix Street Transportation Department.

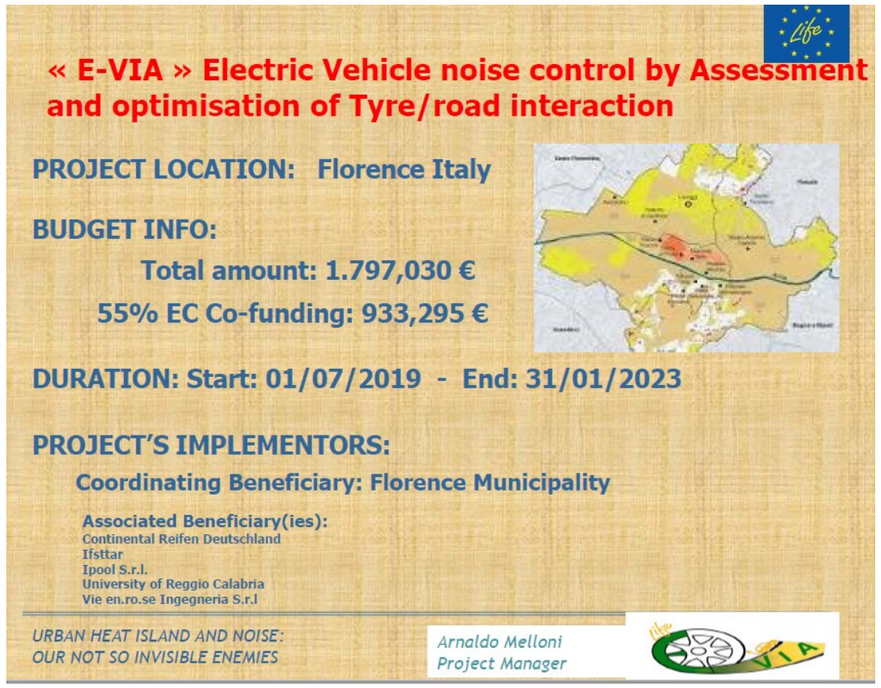
Rubben Lolly. PE, CCPM, Special Projects Administrator, City of Phoenix Street Transportation Department.

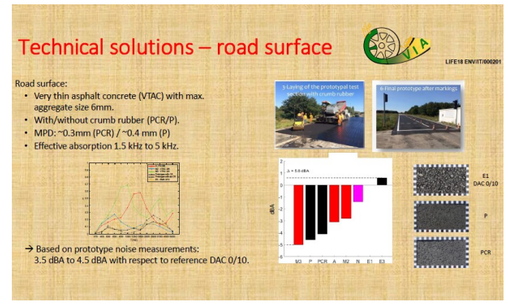
19:00 Cooling LA's Neighborhoods. **COOL STREETS LA** program.

Greg Spotts. Assistant Director and Chief Sustainability Officer StreetsLA.

19:30 Closure

Click here for registration





Paper submitted to EURONOISE 2021

Issued on: October 2021

By: Universitè Gustave Eiffel, UNIRC, IPOOL

Deadline: 31/03/2023

SCIENTIFIC PAPERS

Code: 36_14

euronoise 2021
25th to 27th of October
Madeira, Portugal - online

Acoustical characterization of low-noise prototype asphalt concretes for electric vehicles

Julien Cesbron[1], Simon Bianchetti[2], Marie-Agnès Pallas[2], Filippo G. Praticò[3], Rosario Fedele[3], Gianfranco Pellicano[3], Antonino Moro[4], Francesco Bianco[4]

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Abstract

The paper deals with the acoustical characterization of low-noise asphalt concretes developed for noise reduction in urban areas within the LIFE E-VIA project (LIFE18 ENV/IT/000201). With the perspective of an increasing number of electric vehicles (EVs) in urban area, the asphalt concrete mixes have been optimized considering Life Cycle Cost with respect to actual best practices. Two very thin asphalt concretes (VTAC) of 6 mm maximum aggregate size have been implemented on a reference test track in France. Both are based on the same formulation, but one mix contains 1.9% crumb rubber by weight. The noise performance of these prototype test sections has been evaluated by means of close-proximity (CPX) tests and controlled pass-by (CPB) noise measurements for two EV models. CPX results have shown a noise reduction of about 3 dB(A) by comparison with a reference dense asphalt concrete 0/10, while an average pass-by noise reduction of about 4 dB(A) has been observed for the sample of EVs tested.

Keywords: electric vehicles noise, tyre/road noise, low-noise asphalt concrete, life cycle analysis.

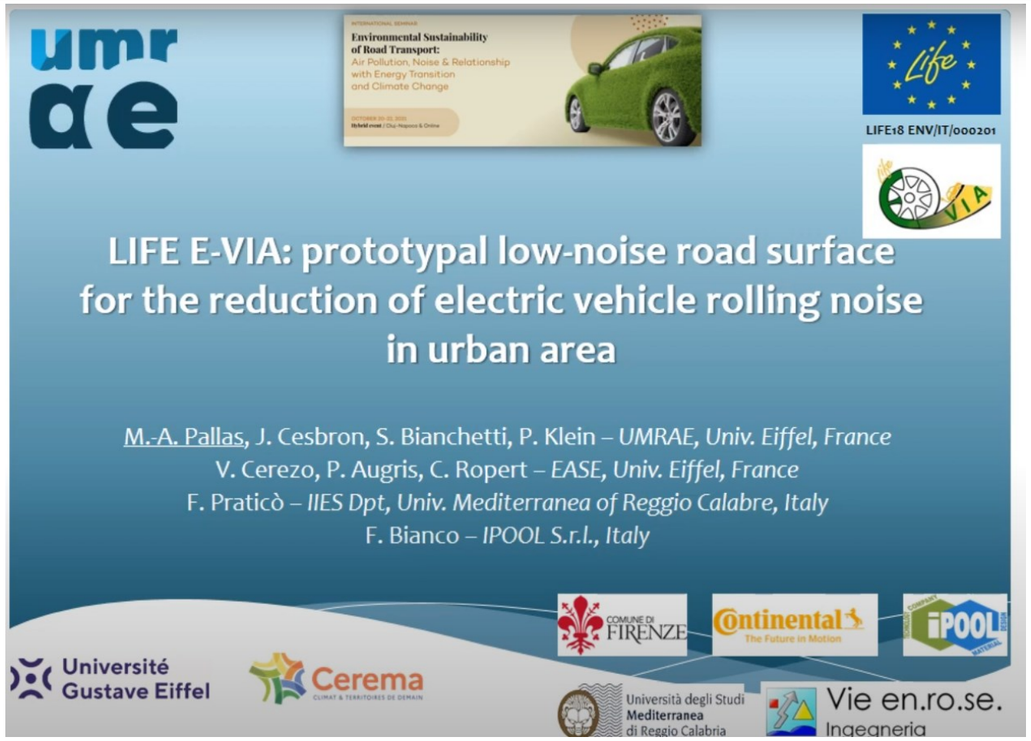
Abstract/ presentation submitted to PIARC International Sustainability of Road Transport

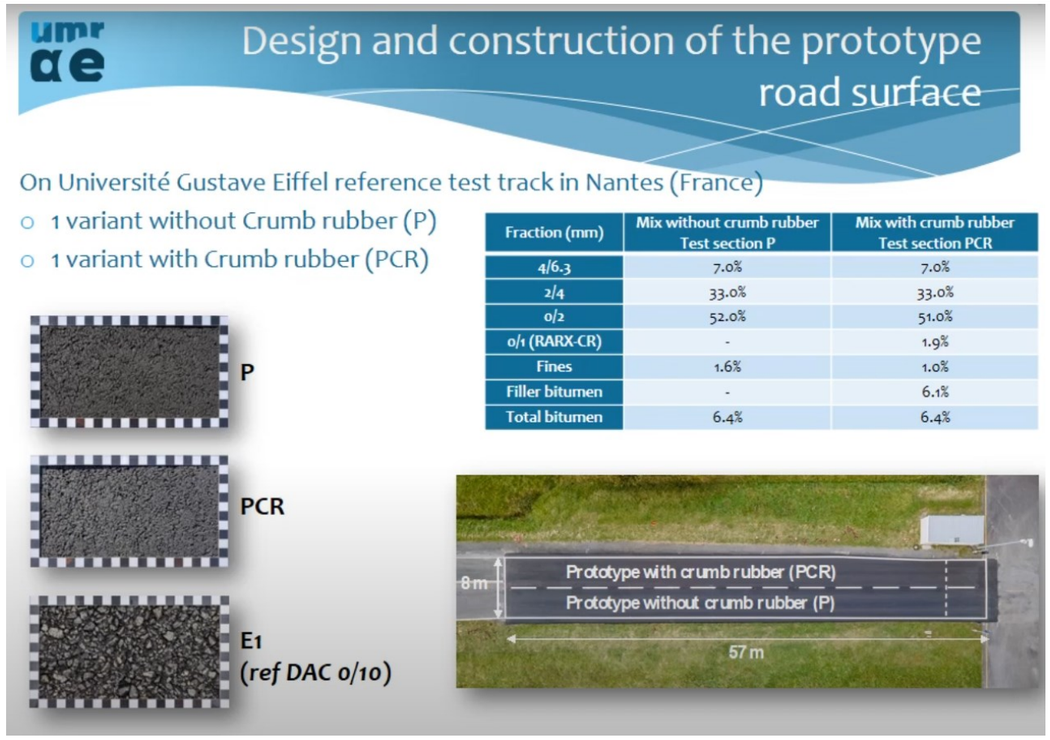
Issued on: October 2021

By: Università Gustave Eiffel, UNIRC, IPOOL

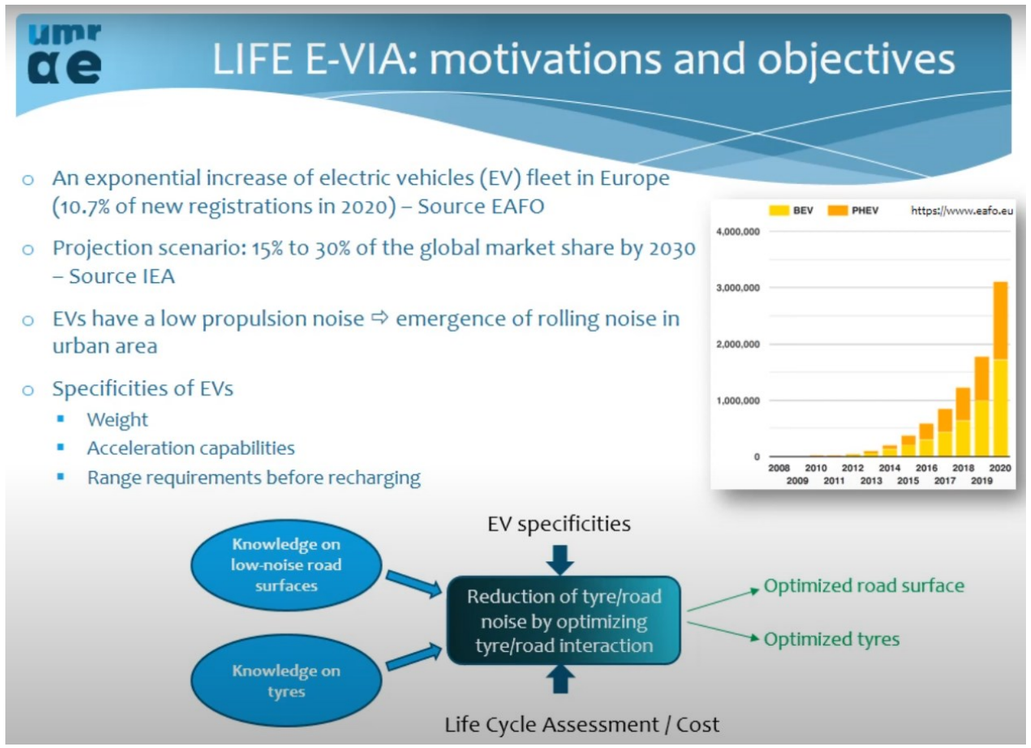
Deadline: 31/03/2023

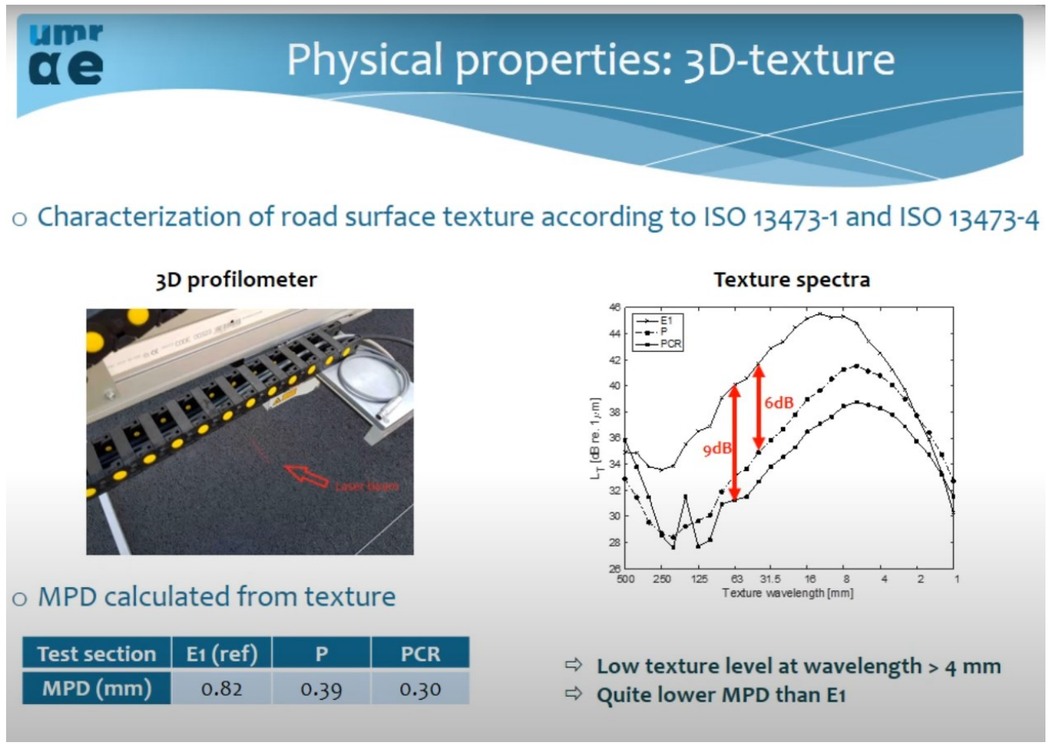
SCIENTIFIC PAPERS
Code: 36_15





Fraction (mm)	Mix without crumb rubber Test section P	Mix with crumb rubber Test section PCR
4/6.3	7.0%	7.0%
2/4	33.0%	33.0%
0/2	52.0%	51.0%
0/1 (RARX-CR)	-	1.9%
Fines	1.6%	1.0%
Filler bitumen	-	6.1%
Total bitumen	6.4%	6.4%





Test section	E1 (ref)	P	PCR
MPD (mm)	0.82	0.39	0.30

Paper submitted to EURONOISE 2021
"Low-noise road mixtures for electric vehicles"

Issued on: October 2021

By: UNIRC

Deadline: 31/03/2023

SCIENTIFIC PAPERS
Code: 36_16

euronoise 2021 25th to 27th of October Madeira, Portugal - online

Low-noise road mixtures for electric vehicles

Filippo G. Praticò[1], Gianfranco Pellicano[1] and Rosario Fedele[1]

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Abstract

The road pavements of the future should be designed to take into account the variation of the traffic noise due to traffic increase and electric vehicles (EVs) diffusion. Indeed, EVs are very different from internal combustion engine vehicles. Importantly, they could be quieter than traditional vehicles at low frequencies, but could be noisier at high frequencies. This study aims at presenting the acoustic and mechanical performance of two asphalt concretes that were designed to reduce the problem mentioned above. In more detail, an experimental investigation was carried out to test samples of asphalt concretes with low nominal maximum aggregate sizes, with and without crumb rubber, added applying the dry method. A gyratory compactor was used to make the samples and acoustic and mechanic properties were tested. Results show that mechanistic-related strategies such as the addition of crumb rubber could improve the acoustic performance. Consequently, there is probably room for improving design criteria.

Keywords: traffic noise, electric vehicles, low-noise road mixtures, acoustic and mechanical performances, crumb rubber.

Task 2) Design/creation of mixtures/samples with and without TCR (1/1)

- Based on the Superpave mix design method, the optimum %B was 5%. Hence, three percentages of bitumen per mix type were considered (about 3%, 5%, and 7%).
- The gyratory compactor revolution number was maintained constant (i.e., 210).
- The TCR was added applying the dry process. TCR seems to negatively affect the compaction level of the samples (cf. G_{mb_DIM}). Hence, %TCR = 2.

Table 2 – Samples' compaction and features.

Type of mixture	Sample ID	Bitumen by mix weight [%]	TCR by mix weight [%]	Gyratory compactor revolution number	Sample dimensions (thickness × diameter) [mm × mm]	Sample weight [g]	G_{mb_DIM} [-]
AC6*	AC6o_3%B_0%TCR_21	3.2	0.0	210	117.4 × 97.5	2066.09	2.36
AC6*	AC6o_5%B_0%TCR_22	5.2	0.0	210	117.2 × 97.5	2109.57	2.41
AC6*	AC6o_7%B_0%TCR_23	7.2	0.0	210	119.6 × 97.5	2154.78	2.41
AC6**	AC6o_3%B_2%TCR_24	3.0	2.0	210	123.7 × 97.5	2105.22	2.28
AC6**	AC6o_5%B_2%TCR_25	5.0	2.0	210	107.0 × 97.5	2151.30	2.39
AC6**	AC6o_7%B_2%TCR_26	7.0	2.0	210	123.9 × 97.5	2198.26	2.36

Symbols. AC6 = Asphalt Concrete with Nominal Maximum Aggregate Size of 6 mm. 3%B = Percentage of bitumen of 3% (w/w by the total weight of the mixture). 0%TCR = Percentage of TCR of 0%. $G_{mb\ DIM}$ = Bulk Specific Gravity calculated considering the characteristics of the sample (dimensions and weight).

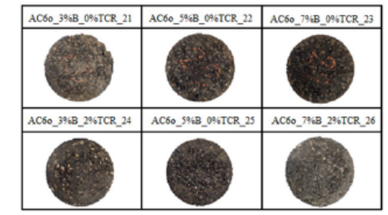

Figure 1 – Upper surfaces of samples.

Task 4) Analysis of the results (5/5)

Figure 4 – Road Acoustic Response (RAR) spectra.

Figure 5 – Road Acoustic Response (RAR) 1/3 octave band spectra.

MI [Ns/m] | K [N/m] | RAR [Pa] Octave bands | RAR [dB] Octave bands | RAR [Pa] 1/3 Octave bands | RAR [dB] 1/3 Octave bands

Task 3) Testing of samples with and without TCR (1/1)

- Six samples (with or without TCR) were tested using the devices in Figure 2.
- The method and the system used to measure both mechanical and acoustic responses were developed by the authors of the paper.

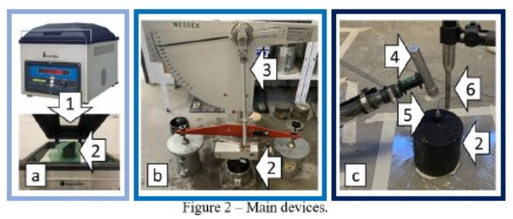

Figure 2 – Main devices.

Notes. 1: Corelok machine. 2: Samples. 3: Pendulum tester. 4: Impact hammer. 5: Accelerometer. 6: Microphone.

Legend: Test → Parameter

a → $G_{mb\_Corelok}$

b → PTV

c → K = Force/Displacement;
MI = Force/Velocity;
RAR = Acoustic response to an impact hammer hit.

LIFE E-VIA: laboratory experiments (IT)

Issued on: December 2021

By: Vie en.ro.se. Ingegneria

Deadline: 31/12/2022

NOTICEBOARD IN ITALIAN LANGUAGE

Code: 23_3

LIFE18 ENV/IT/000201

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LIFE E-VIA

Electric **V**ehicle no**I**se control by **A**ssessment and optimisation of tyre/road interaction

Progettazione della miscela

L'Università 'MEDITERRANEA' di Reggio Calabria (UNIRC) ha analizzato più di 150 soluzioni presenti in letteratura (*strati di usura*), basandosi su *performance* acustiche e non-acustiche, con l'obiettivo di selezionare le soluzioni più appropriate. Sono stati considerati le caratteristiche e gli impatti di ogni soluzione, e sono stati condotti dei test preliminari. Da un totale di 150 conglomerati bituminosi, sono state selezionate nove miscele, sulla base delle seguenti caratteristiche: 1) Risposta Acustica; 2) "Durata di vita", facendo riferimento alle attività Meccaniche; 3) Permeabilità; 4) Frizione; 5) Valore ENDT. Sulla base di queste caratteristiche, sono stati selezionati conglomerati bituminosi con aggregato massimo nominale di 6 mm (AC6).
Un accurato piano di esperimenti ha permesso di progettare e validare le miscele scelte. Infine sono state progettate e testate due tipologie di miscele (AC6 con e senza polverino di gomma).

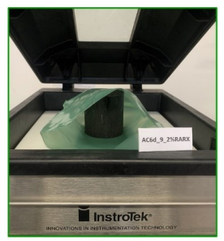
Compattazione metodo Superpave

Esperimenti di Laboratorio

Resistenza al flusso d'aria

Assorbimento Acustico

Impedenza meccanica



Corelok

Permeabilità

Skid Test

Sand Patch Test

Stabilità Marshall

Sito web: https://life-evia.eu/

LIFE E-VIA: survey ante/post operam (IT)

Issued on: December 2021

By: Vie en.ro.se. Ingegneria

Deadline: 31/12/2022

NOTICEBOARD IN ITALIAN LANGUAGE

Code: 23_4

LIFE18 ENV/IT/000201

With the contribution of the LIFE programme of the European Union

LIFE E-VIA

Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction

Il Caso Pilota

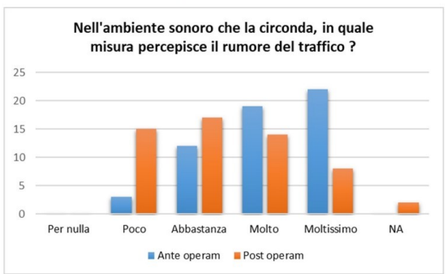
Nella seconda metà del mese di luglio 2021 sono stati realizzati gli interventi nel caso pilota di via Paisiello (Firenze): su un tratto di strada è stato steso un innovativo asfalto a bassa emissione sonora per ridurre l'inquinamento acustico. Al fine di valutare la percezione dei cittadini, prima e dopo la realizzazione dei lavori, sono stati somministrati questionari ai residenti nel tratto di strada interessato. Ad inizio luglio, sono stati consegnati 92 questionari ante-operam, di questi, 56 sono stati restituiti compilati. Successivamente alla realizzazione dei lavori (settembre), sono stati consegnati 101 questionari post-operam, dei quali 56 sono stati riconsegnati compilati. L'analisi dei dati mostra che la stesa dell'asfalto a bassa emissione acustica ha avuto un impatto positivo per quanto riguarda la percezione del rumore. In particolare, il 77% degli intervistati ha valutato in maniera positiva gli effetti dell'asfalto sviluppato dal progetto sulla riduzione del rumore causato dal traffico.

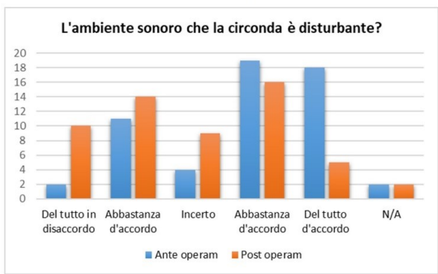
Contesto e strumento metodologico

Il caso pilota a Firenze

Questionari ante-operam

Analisi dei dati





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LIFE E-VIA: survey ante/post operam (EN)

Issued on: December 2021

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Code: 18_5

LIFE E-VIA

Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction

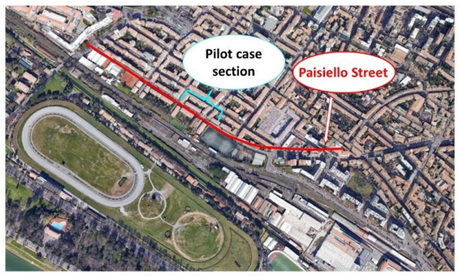
LIFE18 ENV/IT/000201

With the contribution of the LIFE programme of the European Union

The Pilot case

The interventions in the pilot case located in Paisiello street (Florence) have taken place in mid July 2021: an innovative low-noise asphalt that aims to reduce traffic noise pollution was laid down in a portion of the street. In order to evaluate citizens soundscape perception before and after the pilot intervention realization, ante-operam and post-operam questionnaires were submitted to Paisiello street's residents. In particular, 92 ante-operam questionnaires were delivered, and 56 completed questionnaires were returned. In September, 101 post-operam questionnaires were delivered and 56 returned. The analysis shows a positive subjective impact of the low-noise asphalt implementation. As an illustration, according to 77% of the respondents the re-paving reduced the traffic noise perceived in their home.

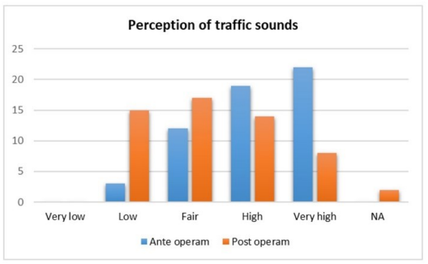
Context and Methods

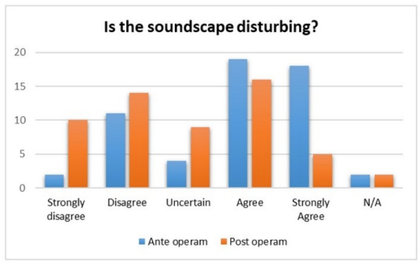


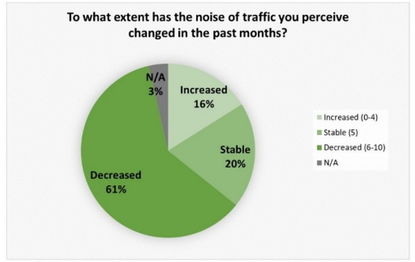
The pilot case in Florence

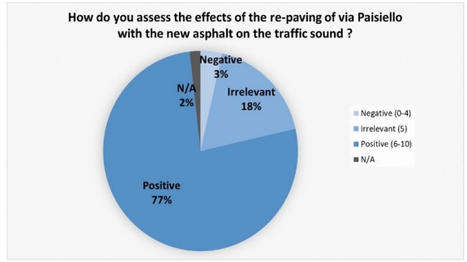
Delivered Questionnaires

Survey' Analysis









Website: https://life-evia.eu/

LIFE E-VIA: laboratory experiments (DE)

Issued on: December 2021

By: Continental

Deadline: 31/12/2022

NOTICEBOARD IN GERMAN LANGUAGE

Code: 22_3

LIFE18 ENV/IT/000201

Mit Unterstützung des LIFE-Förderprogramms der Europäischen Union

LIFE E-VIA

Electric **V**ehicle no**I**se control by **A**ssessment and optimisation of tyre/road interaction

Mischungs-design

Die Università Mediterranea Di Reggio Calabria (UNIRC) hat zur Findung eines optimalen Straßenbelags mehr als 150 in der einschlägigen Literatur erwähnte Deckschichten auf ihre akustischen und nicht-akustischen Leistungsfähigkeiten untersucht. Weiterhin wurde die Umweltverträglichkeit berücksichtigt und eine Reihe von Vortests durchgeführt. Auf dieser Basis wurden von den 150 Vorschlägen neun Asphaltbetonmischungen ausgewählt, wobei besonderer Fokus auf (1) die akustischen Eigenschaften; (2) die auf Basis der mechanischen Eigenschaften zu erwarteten Lebensdauer; (3) die Permeabilität; (4) die Friktionseigenschaften; und (5) den END_T-Wert (gemäß ISO 10844) gelegt wurde. Aus diesen wurden dann Asphaltbetonmischungen mit einer maximalen nominalen Korngröße von 6 mm (AC6) ausgewählt. Mittels einer detaillierten Reihe von Experimenten wurden schließlich die finalen zwei Mischungen entwickelt und validiert. Es handelt sich dabei um zwei AC6-Mischungen mit/ohne Gummigranulatanteil.

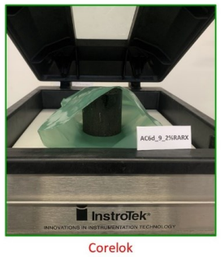
Asphaltbeton-verfestigung

Labor-experimente

Strömungswiderstand

Akustische Absorption

Mechanische Impedanz



Corelok

Permeabilität

Reibungsmessung

Sandfleckverfahren

Marshall-Stabilität

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LIFE E-VIA: laboratory experiments (FR)

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NOTICEBOARD IN ITALIAN LANGUAGE

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LIFE E-VIA

LIFE18 ENV/IT/000201

With the contribution of the LIFE programme of the European Union

Contrôle du bruit des Véhicules Électriques par l'évaluation et l'optimisation de l'interaction pneumatique/chaussée

Conception du mélange

L'Université « méditerranéenne » de Reggio de Calabre (UNIRC) a analysé plus de 150 solutions de surface routière disponibles dans la littérature, sur la base de leurs performances acoustiques et non acoustiques, pour sélectionner les solutions pertinentes. Leurs caractéristiques et impacts ont été considérés et des tests préliminaires ont été effectués. À partir des 150 bétons bitumineux, neuf formulations ont été retenues, selon de nombreux critères incluant : 1) la réponse acoustique; 2) la durée de vie relativement aux propriétés mécaniques; 3) la perméabilité; 4) l'adhérence; 5) la valeur ENDT (« Expected pass-by Noise level Difference from Texture level variation of the road surface »).
Pour cette dernière, des bétons bitumineux ouverts de taille nominale de granulats 6 mm (AC6) ont été retenus.
Un plan d'expérience précis a été élaboré et appliqué pour concevoir et valider la formulation définitive. Deux variantes ont finalement été réalisées et testées (AC6 avec et sans poudrette de caoutchouc).

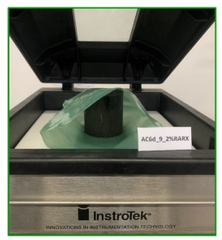
Compactage Superpave

Tests en laboratoire

Résistance au passage de l'air

Absorption acoustique

Impédance mécanique



Corelok

Perméabilité

Essais d'adhérence

Mesure de la tache au sable

Stabilité Marshall

Site web: https://life-evia.eu/

LIFE E-VIA: Tyre role in the context of EV and ICEV (EN)

Issued on: January 2022

By: Continental

Deadline: 31/12/2022

NOTICEBOARD IN ENGLISH LANGUAGE

Code: 18_6

LIFE E-VIA

Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction

LIFE18 ENV/IT/000201

With the contribution of the LIFE programme of the European Union

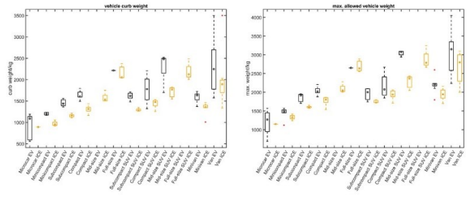
Tyre role in the context of EV and ICEV

Electric vehicles (EV) differ from their traditional internal combustion engine (ICEV) counterparts in many technical or design features. Some of these changes can influence the rolling noise created by the interaction of the tyre with the road. These parameters are for example increased vehicle loads due to the battery weight which is necessary to provide acceptable mileage, special acceleration/deceleration behaviour due to the different torque characteristic of electrical motors and the recuperation, possible new tyre size trends ("tall-and-narrow") being introduced for mileage, handling or aesthetic reasons, etc. In an analysis of the current and future European EV market it has thus been assessed whether there are systematic differences between EVs and ICEVs which would affect tyre/road noise by any of the previously described mechanisms.

Vehicle weight

Background: Commonly, an increase in tyre load can be associated with an increase in tyre/road noise. While the extend of this load influence on rolling noise depends on tyre type, speed, road surface and inflation pressure, an increase in SPL of 0.5 dB to 2.5 dB per load doubling is typically reported in literature. If an increase in tyre loads necessitates an increase in tyre inflation pressure or tyre construction, further negative effects on tyre/road noise can be expected.

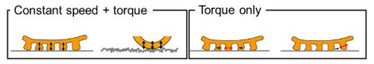
Observations: The results indicate that on average EVs are between 20 % and 25 % heavier than ICEVs in curb weight and roughly 10 % to 15 % in maximum weight. This will negatively influence tyre/road noise generation. Often this is accompanied by an increase in tyre inflation pressure – either for load carrying or rolling resistance reasons – which will further increase rolling noise.

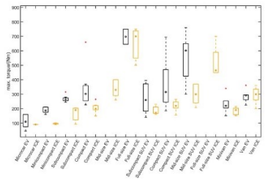


Vehicle torque

Background: Compared to constant speed driving, tyre torque due to acceleration or braking can increase tyre/road noise by several dB. Again, the extend of this increase depends highly on tyre design and operating conditions. This noise increase is caused by micro-scale adhesion and friction mechanisms which are responsible for phenomena like stick/slip and stick/snap which lead to additional tangential vibrations of the tread blocks which are of minor importance under free rolling.

Observations: Definite conclusions regarding EV tyre torque are difficult because of a lack of specific data and the large influence of electronic control systems and driving behaviour. Engine torque is in nearly all cases higher for EVs, both in terms of maximum torque as well as the RPM range where this is available. Assuming similar vehicle control systems and driving behaviour to ICEVs this means that tyre torque is potentially also higher for EVs. Combined with reports that over a third of EV fleet users exhibit a more aggressive driving behaviour a worst-case assumption of increased tyre torque for EVs seems reasonable.

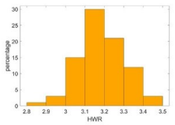




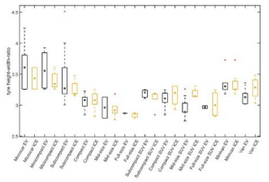
Tyre sizes

Background: The sound radiation from the area close to the tyre/road contact patch is amplified by the horn-like geometry formed between tyre and road. This amplification is frequency dependent with average amplifications of 5 dB to 12 dB per third-octave band having been reported for complex pass-by situations. The amplification is strongly affected by tyre width, with smaller tyres reducing the amplification effect. Tall-and-narrow tyre concepts as used by some EVs (e.g. BMW i3) have a significant influence on the amplification from the horn effect, affecting both the frequency and the amplitude of the peak amplification.

Observations: New tyre size concepts, for example tall-and-narrow, are not widely employed for EVs. Contrary, for EVs based on an ICEV platform usually no changes in tyre size are observed. For new EV platforms often only slight adjustments in tyre sizes are noticeable, typically in form of a small increase in tyre diameter and/or width. The relation between tyre height and width, defined here as height-width-ratio $HWR = \text{tyre diameter/tyre width}$, which is important for the amplification of the sound radiation, mostly stays in the same range as established for classical ICEV applications.



Height-width-ratio for the typical tyre sizes used by the 50 most sold ICEVs in the European market in 2019.



Web site: https://life-evia.eu/

LIFE E-VIA: Tyre role in the context of EV and ICEV (DE)

Issued on: January 2022

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Mit Unterstützung des LIFE-Förderprogramms der Europäischen Union

LIFE E-VIA

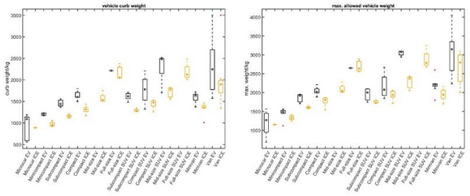
Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction

Die Rolle des Reifens im Kontext des Wechsels von ICEVs zu EVs

Elektrofahrzeuge (EV) unterscheiden sich von ihren Gegenstücken mit Verbrennungsmotor (ICEV) in vielen Technik- und Designaspekten. Einige dieser Unterschiede können einen Einfluss auf das durch die Reifen-/Fahrbahninteraktion verursachte Rollgeräusch haben. Dabei handelt es sich z.B. um erhöhte Fahrzeuglasten aufgrund des für akzeptable Reichweiten nötigen Batteriegewichtes; spezielles Beschleunigungs-/Bremsverhalten aufgrund der speziellen Drehmomenteigenschaften von elektrischen Motoren und der Rekuperation; oder neue Reifengrößen (*tall-and-narrow*) welche aus Gründen der Reichweite, des Handlings oder der Ästhetik eingeführt werden. In einer Analyse des europäischen EV Marktes wurde deswegen untersucht, inwieweit es systematische Unterschiede zwischen EVs und ICEVs gibt, die das Reifen-/Fahrbahngeräusch durch die genannten Mechanismen beeinflussen können.

Fahrzeug-gewicht

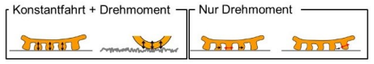
Ausgangslage: Eine erhöhte Reifenlast kann mit einer Zunahme des Reifen-/Fahrbahngeräusches in Verbindung gebracht werden. Der Umfang dieses Lasteinflusses hängt u.a. vom Reifen, dem Fülldruck, der Geschwindigkeit und dem Straßenbelag ab. In der Literatur wird typischerweise eine Zunahme des Gesamt-schalldruckpegels um 0,5 dB bis 2,5 dB pro Lastverdopplung berichtet. Falls eine Erhöhung der Reifenlast auch einen erhöhten Fülldruck oder eine geänderte Reifenkonstruktion verlangt, ist mit einer weiteren Zunahme des Rollgeräusches zu rechnen.

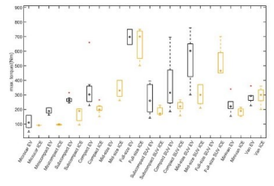


Beobachtung: Die Ergebnisse zeigen, dass EVs im Durchschnitt ein 20 % bis 25 % höheres Leergewicht als ICEVs haben und ein etwa 10 % bis 15 % höheres Maximalgewicht. Dies hat einen negativen Einfluss auf das Reifen-/Fahrbahngeräusch. Oftmals liegt zusätzlich – aus Gründen der Lastkapazität oder der Reichweite – ein erhöhter Fülldruck vor, durch den das Rollgeräusch potenziell weiter zunimmt.

Drehmoment

Ausgangslage: Im Vergleich zur Konstantfahrt kann ein Reifendrehmoment durch Beschleunigung oder Bremsen das Rollgeräusch um mehrere dB(A) erhöhen. Der Umfang dieser Zunahme hängt wiederum vom Reifendesign und den Betriebsbedingungen ab. Verursacht wird diese Zunahme durch kleinskalige Adhäsions- und Friktions-prozesse welche zu Phänomenen wie stick/slip oder stick/snap führen. Diese erzeugen zusätzliche tangentiale Vibrationen der Profilblöcke, die unter freien Rollen nur von geringer Bedeutung sind.



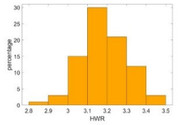


Beobachtung: Aufgrund mangelnder Daten zum EV-Reifendrehmoment, und des Einflusses von elektrischen Kontrollsystemen und dem Fahrverhalten ist eine konkrete Aussage schwierig. Das Motordrehmoment ist für EVs nahezu immer höher, sowohl als Maximalwert als auch als Umdrehungszahlbereich in dem dieser erreicht wird. Wird von ähnlichen Kontrollsystemen und zumindest nicht deutlich passiverem Fahrverhalten ausgegangen, bedeutet dies, dass das Reifendrehmoment von EVs mit großer Wahrscheinlichkeit auch höher ist.

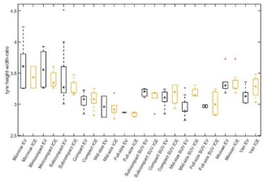
Reifengröße

Ausgangslage: Die Schallabstrahlung aus der unmittelbaren Umgebung des Reifen-/Fahrbahnkontaktes wird durch die einem Horn ähnelnde Geometrie zwischen Reifen und Fahrbahn verstärkt. Für diese frequenzabhängige Verstärkung sind für komplexe Vorbeifahrtsituationen Erhöhungen von 5 dB bis 12 dB pro Terzband beobachtet worden. Der Effekt hängt stark von der Reifenbreite ab, wobei schmalere Reifen zu einer geringeren Erhöhung führen. Tall-and-narrow Reifenkonzepte, wie sie von einigen EVs (z.B. BMW i3) genutzt werden, haben einen signifikanten Einfluss auf die verstärkte Schallabstrahlung durch den Horneffekt. Dabei wird sowohl die maximale Verstärkung als auch der relevante Frequenzbereich beeinflusst.

Beobachtung: Neue Reifengrößenkonzepte, z.B. tall-and-narrow, werden nicht in großen Umfang von Evs benutzt. Im Gegenteil, für EVs die auf klassischen ICEV-Plattformen basieren, ist im Normalfall keine Änderung der Reifengröße zu beobachten. Für neue EV-Plattformen ergeben sich oftmals nur geringe Anpassungen der Reifendimensionen, typischerweise in Form einer leichten Zunahme von Reifenbreite und/oder Felgendurchmesser. Das Verhältnis zwischen Reifenhöhe und –breite, hier definiert als height-width-ratio $HWR = \text{Reifendurchmesser}/\text{Reifenbreite}$, welches für die Verstärkung der Schallabstrahlung von Bedeutung ist, liegt Größtenteils im selben Bereich wie für klassische ICEVs.



Height-width-ratio für die typischen Reifengrößen, die von den 50 meist-verkauften Fahrzeugen auf dem europäischen Markt in 2019 benutzt wurden.



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Paper published in an open access journal
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Issued on: December 2021
By: UNIRC
Deadline: 01/12/2022

ARTICLES FOR OPEN ACCESS JOURNAL
Code: 20_2

DE GRUYTER Noise Mapp. 2021; 8:281–294

Research Article

Filippo Giammaria Praticò and Rosario Fedele*

Electric vehicles diffusion: changing pavement acoustic design?

https://doi.org/10.1515/noise-2021-0023
Received May 11, 2021; accepted Oct 31, 2021

Abstract: Electric vehicles (EVs) are progressively entering into the current noisy urban ecosystem. Even though EVs are apparently quieter than traditional Internal Combustion Engine Vehicles (ICEVs), they have an impact on noise maps and road pavement designers should take this into consideration when designing future low-noise road pavements. Consequently, the main objective of this study is to define what are the most important aspects that road pavement designers should take into account. For this reason, in this paper, the noise emitted by EVs was analysed, considering parameters (*e.g.*, speed and frequency) and comparisons, in order to identify crucial characteristics. Results show that EV noise could call for the improvement of pavement acoustic design due to the Acoustic Vehicle Alerting System (AVAS), high-frequency peaks, and noise vibration harshness.

Keywords: Internal combustion engine vehicles, Electric vehicle, Traffic noise, Road pavement design

1 Introduction

We tend to think that Electric vehicles (EVs) are quite silent, but it was amply proved that electric motors can emit noise [1]. The advent of EVs into the current traffic-noise-related ecosystem can be compared to the introduction of a new species in a given ecosystem [2], which need to be studied considering different points of view, *i.e.*, of authorities, pedestrians, drivers, and designers. Hence, designers should consider the impact of EVs on noise maps (especially in urban contexts), and take this into consideration when designing future low-noise road pavements [3].

The first outcome of the studies mentioned above refers to the "excessive quietness" of EVs, especially at low speeds, *e.g.*, Sound Pressure Levels lower than 56 dB @about 10 km/h, cf. also [4]. This may affect the safety of pedestrians, riders, and Internal Combustion Engine Vehicles (ICEVs) drivers [4–6]. In order to solve this problem, regulation and systems have been proposed as discussed in the following (see Section 1.3).

Another important aspect related to the noise produced by vehicles (including EVs) is the tire/road interaction. Hence, solutions related to tires and roads were proposed.

Focusing on tires designed for EVs, Ejsmont *et al.* (2015) [7] concluded that these special tires generate noise similar to general use tires, and that a small noise reduction can be possible if narrow tires with big outer diameter are used. In 2016, Pallas *et al.* (2016) and Czuka *et al.* (2016) [8, 9], within the FOREVER project, investigated the tire/road noise of EVs, and the "low-noise tires" concept (using one EV and nine different tire sets) concluding that:

1. The rolling noise of light EVs does not differ from the one of conventional vehicles.
2. Ecological tires (*i.e.*, which reduce consumption) and current tires for EVs do not reduce significantly the rolling noise.

Mohammadi and Ohadi (2021) [10] proposed a novel approach to design quiet tires, based on multi-objective minimization of generated noise. In this latter study, all the predominant mechanisms related to tire/road noise (texture impact, tread impact, air pumping, pipe resonance, Helmholtz resonance, air cavity resonance, and horn effect) were included in the model. On average, this allowed reducing of about 2 dB(A) the total noise (corresponding to 80% reduction of the normalized texture impact noise), and of 27% the average normalized sound of a patterned tire, by modifying of about the 10% its structural and tread pattern parameters.

For quiet asphalt pavements, it is important to point out that their sound absorption can be modelled [11, 12] and measured using in-lab and on-site methods [13]. Furthermore, road sound absorption is related to several parameters (*i.e.*, thickness, porosity, air flow resistivity, and tortuosity), and more attention should be paid on the im-

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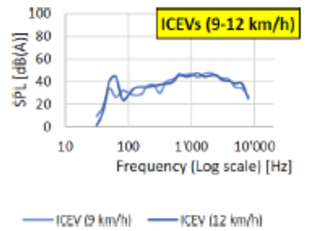
https://www.degruyter.com/document/doi/10.1515/noise-2021-0023/html

within the range 500 Hz–1.6 kHz, while for heavy EVs is within 630 Hz and 2.5 kHz).
5. Based on measured data, the equivalent frequency (*i.e.*, the frequency, selected among all the center frequencies of 1/3 bands between 350 Hz and 2500 Hz, that is more often associated to the maximum A-weighted sound pressure level) of light EVs and light ICEVs is 1000 Hz and 800 Hz, respectively. While the same parameter for heavy EVs and heavy ICEVs is 1000 Hz and 630 Hz, respectively.
6. Simulations showed that if the percentage of EVs increases of 10%, the noise of the traffic flow decreases of 7 dB(A).

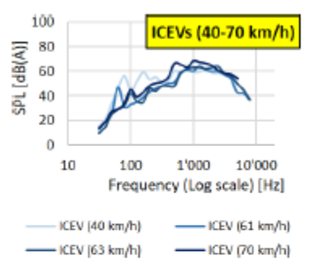
The following figures (Figures 3-5) show several noise spectra related to both light and heavy ICEVs and EVs [31, 32, 37, 45, 52]. In particular, these figures report the A-weighted Sound Pressure Level of:

1. ICEVs (see Figure 3) and EVs (see Figure 4), moving at different speeds (9–70 km/h), measured applying the Statistical Pass-By method (ISO 11819-1:1997).
2. EVs (see Figure 5) moving at constant speeds, derived applying the method described in the ISO 362-1-1:2015.

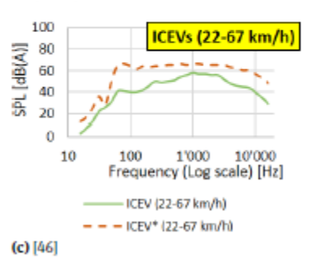
Note that the measurements related to heavy vehicles were pointed out by using asterisks.



(a) [31]

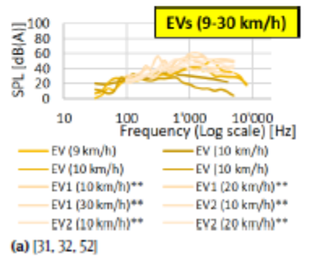


(b) [31, 32]

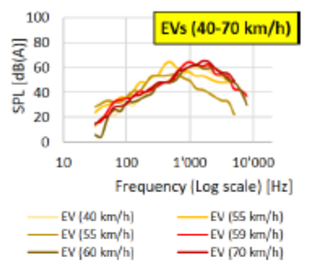


(c) [46]

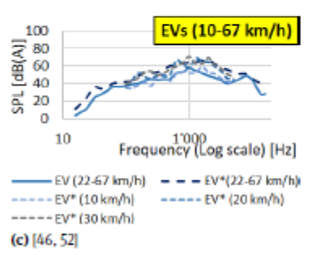
Figure 3: A-weighted Sound Pressure Level (Statistical Pass-By method, ISO 11819-1:1997) of ICEVs at different speeds (* – heavy vehicle) [31, 32, 45].



(a) [31, 32, 52]



(b) [31, 32]



(c) [46, 52]

Figure 4: A-weighted Sound Pressure Level (Statistical Pass-By method, ISO 11819-1:1997) of EVs at different speeds (* – heavy vehicle; ** – motorcycle) [31, 32, 45, 52].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