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 5TH December 2022 - Firenze

Comune di Firenze

Responsible for actions B3, B8, E1, E2

Iacopo Bianchi, Cecilia Cantini, **Arnaldo Melloni,** Gessica Pecchioni, Ilaria Nasti

COMUNE DI FIRENZE

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

LIFE18 ENV/IT/000201 E-VIA
Electric Vehicle noIse control by Assessment and optimisation of tyre/road interaction

IV Monitoring visit

<u>Agenda</u>

- 10:00 - 13:00 Technical presentation

- 13:00 - 14:30 Lunch Break

- 14:30 - 16:00 Administrative and financial session (*)

(*) the administrative and financial part could be much shorter than expected.

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	✔
B4 New road surfaces efficiency tests performing	B4	31/08/2022	✔
B6 Guidelines issuing	B6	30/09/2022	
B7 New optimized tyre testing	B7	31/12/2022	
B8 Replicability and Transferability Plan	B8	31/12/2022	
D2 EV Festival	D2	31/12/2022	✔
Final event	E1	31/01/2023	✔

LIFE18 ENV/IT/000201
LIFE E-VIA PROJECT
5 December 2022 – Comune di Firenze

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	✔
Video of the prototype construction	D1	31/12/2021	✔
B3 Report about the implementation in the pilot	B3	31/03/2022	✔
B5 Report	B5	30/04/2022	✔
3 press conferences	D1	31/07/2022	✔
B6 Report	B6	30/09/2022	
Guideline about the use and application of the methodology output	B6	30/09/2022	
B4 Report	B4	31/10/2022	
1 Article Published in an open access top ranked journal	D2	31/12/2022	
1 Article for local magazines about EV Festival	D2	31/12/2022	

2 Open source articles on peer-reviewed international journal for dissemination of the obtained results	D2	31/12/2022	
3 Articles for peer-reviewed open access journal (e.g., Materials , MDPI, and Applied Acoustics)	D2	31/12/2022	
5 noticeboards in French language	D1	31/12/2022	✔
5 noticeboards in German language	D1	31/12/2022	✔
5 noticeboards in Italian language	D1	31/12/2022	✔
Report on yearly participation in INAD (3 reports 2020,2021,2022)	D1	31/12/2022	✔
1 promotional video about EV FESTIVAL	D2	31/01/2023	✔
After LIFE Plan	E2	31/01/2023	
B7 report	B7	31/01/2023	
B8 Report containing Replicability and Transferability plan	B8	31/01/2023	
B8 Technology exploitation plan for the transfer of EV tyre noise optimization technology into the market by CRD	B8	31/01/2023	
C1 Report	C1	31/01/2023	
C2 Report	C2	31/01/2023	
Exploitation Plan (Tyres -> CRD / Asphalts -> UNIRC)	E2	31/01/2023	
Final project report	E1	31/01/2023	
Layman's report	D1	31/01/2023	
17 different scientific papers to be presented in national / international congresses	D2	31/03/2023	✔
Proceedings of Final Event in Florence (USB Keys) - 400 copies	D2	31/03/2023	✔

ACTION B3

Activities planned under Action B3:

B3.1 Pilot area: implementation ✓

Results already presented during the last monitoring visit!

2 tracks: Reference track + Optimized track

B3's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline	
B3 Tender specification definition	02/2021	✓
B3 Report about the implementation in the pilot area	03/2022	✓

B3's PROJECT MILESTONES

Milestone name	Deadline	
B3 Tender's assignment	05/2021	✓
B3 Construction of low-noise tracks in the pilot area	09/2021	✓

ACTION B8

Expected results under Action B8:

RT1: LOW NOISE SURFACES
During the project lifetime **1-2 applications** of the solutions that will be **proposed by the project in terms of optimized pavements will be implemented by suggesting them in the next noise mapping round** (VIENROSE, IPOOL). In particular it is planned to realize the following two areas, both inside the Low Emission Zone of the city of Florence, where hence more electric vehicles pass compared to the areas outside the LEZ: the first in "Via della Scala" (about 200/300m), and the second inside the entire Cascine park (about 500m).
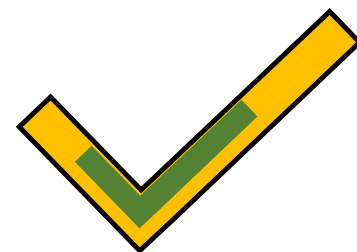
One of the areas identified have changed, work is in the process of being assigned but has been postponed until early 2023 due to urgent work by Publiacqua (water service agency)

DOCUMENTO PER LA VERIFICA DEL RISPETTO DEI CRITERI DI SELEZIONE E DEL CONTRIBUTO AI RISULTATI DEL PON METRO

> **Asse 6 - Ripresa verde, digitale e resiliente (REACT-EU FESR)**
> **OS 6.1 Transizione verde e digitale delle città metropolitane**
> **Azione 6.1.4 – Qualità dell'ambiente e adattamento ai cambiamenti climatici**
> **Operazione codice locale progetto FI6.1.4 " Piano di Risanamento Comunale " -**
> **finanziato nell'ambito della risposta dell'Unione alla pandemia di Covid-19**

Completamento del Piano di Risanamento Acustico Comunale - asfalto fonoassorbente compreso risanamento del sottofondo - tratto via Senese - REACTEU - cod opera 210290

Trimestre	2021				2022				2023			
	1	2	3	4	1	2	3	4	1	2	3	4
Progettazione							x					
Aggiudicazione								x				
Realizzazione									x	x	x	
Chiusura intervento												x

Completamento del Piano di Risanamento Acustico Comunale - pavimentazioni fonoassorbenti via delle Cascine, via Paisiello, via delle Porte Nuove, via del Ponte alle Mosse

Trimestre	2021				2022				2023			
	1	2	3	4	1	2	3	4	1	2	3	4
Progettazione						x	x	x				
Aggiudicazione								x	x			
Realizzazione									x	x		
Chiusura intervento											x	x

Completamento del Piano di Risanamento Acustico Comunale - asfalto fonoassorbente compreso risanamento del sottofondo - tratto via Bolognese - REACTEU - cod opera 210291

Trimestre	2021				2022				2023			
	1	2	3	4	1	2	3	4	1	2	3	4
Progettazione							x					
Aggiudicazione								x				
Realizzazione									x	x	x	
Chiusura intervento												x

Tabella 1 – Quadro Economico dell'operazione

Completamento del Piano di Risanamento Acustico Comunale - asfalto fonoassorbente compreso risanamento del sottofondo - tratto via Senese - REACTEU - cod opera 210290

Voci di spesa	Importo (€)	Note
Materiali inventariabili		
Materiali di consumo		
Costi per elaborazione dati		
Personale non dipendente da destinare allo specifico progetto		
Servizi esterni (compresi lavori)	395.481,57	(include lavori, oneri sicurezza non soggetti a ribasso e spese per incarichi esterni)
Missioni		
Convegni		
Pubblicazioni		
Costi forfettizzati e spese generali		
Consulenze e spese di deposito (per brevetti)		
Pagamento tasse di deposito o mantenimento (per brevetti)		
Costo del personale dipendente della PA		
IVA	90.163,94	
Altro	14.354,48	(include incentivo per funzioni tecniche, imprevisti, rilievi e indagini, allacciamenti e altre voci non incluse nelle precedenti elencazioni)
TOTALE	500.000,00*	

*il totale della scheda progetto allegata al provvedimento di approvazione dell'OI è pari ad €

Completamento del Piano di Risanamento Acustico Comunale - asfalto fonoassorbente compreso risanamento del sottofondo - tratto via Bolognese - REACTEU - cod opera 210291

Voci di spesa	Importo (€)	Note
Materiali inventariabili		
Materiali di consumo		
Costi per elaborazione dati		
Personale non dipendente da destinare allo specifico progetto		
Servizi esterni (compresi lavori)	395.481,57	(include lavori, oneri sicurezza non soggetti a ribasso e spese per incarichi esterni)
Missioni		
Convegni		
Pubblicazioni		
Costi forfettizzati e spese generali		
Consulenze e spese di deposito (per brevetti)		
Pagamento tasse di deposito o mantenimento (per brevetti)		
Costo del personale dipendente della PA		
IVA	90.163,94	
Altro	14.354,48	(include incentivo per funzioni tecniche, imprevisti, rilievi e indagini, allacciamenti e altre voci non incluse nelle precedenti elencazioni)
TOTALE	500.000,00*	

Completamento del Piano di Risanamento Acustico Comunale - pavimentazioni fonoassorbenti via delle Cascine, via Paisiello, via delle Porte Nuove, via del Ponte alle Mosse

Voci di spesa	Importo (€)	Note
Materiali inventariabili		
Materiali di consumo		
Costi per elaborazione dati		
Personale non dipendente da destinare allo specifico progetto		
Servizi esterni (compresi lavori)	538.627,47	(include lavori, oneri sicurezza non soggetti a ribasso e spese per incarichi esterni)
Missioni		
Convegni		
Pubblicazioni		
Costi forfettizzati e spese generali		
Consulenze e spese di deposito (per brevetti)		
Pagamento tasse di deposito o mantenimento (per brevetti)		
Costo del personale dipendente della PA		
IVA	114.021,79	
Altro	15.065,02	(include incentivo per funzioni tecniche, imprevisti, rilievi e indagini, allacciamenti e altre voci non incluse nelle precedenti elencazioni)
TOTALE	**667.714,28***	

Cronoprogramma di spesa per operazioni "multi-intervento"

asfalto fonoassorbente compreso risanamento del sottofondo - tratto via Senese - REACTEU - cod opera 210290

Cronoprogramma Finanziario	Totale operazione***	Intervento Codice locale progetto	Intervento Codice locale progetto	Intervento Codice Locale progetto
2021				
2022	10.000,00			
2023	490.000,00			
TOTALE	500.000,00			

asfalto fonoassorbente compreso risanamento del sottofondo - tratto via Bolognese - REACTEU - cod opera 210291

Cronoprogramma Finanziario	Totale operazione***	Intervento Codice locale progetto	Intervento Codice locale progetto FI	Intervento Codice locale progetto
2021				
2022	10.000,00			
2023	490.000,00			
TOTALE	500.000,00			

pavimentazioni fonoassorbenti via delle Cascine, via Paisiello, via delle Porte Nuove, via del Ponte alle Mosse

Cronoprogramma Finanziario	Totale operazione***	Intervento Codice locale progetto	Intervento Codice locale progetto FI	Intervento Codice locale progetto
2021				
2022				
2023	667.714,28			
TOTALE	667.714,28			

More than 25,000 mq of asphalt with technical characteristics analogous to those of the E-VIA project in 2023

QUADRO ECONOMICO DEI SINGOLI INTERVENTI CENSITI NELL'OPERAZIONE:

- Intervento codice locale progetto Codice locale progetto FI_6.1.4

Completamento del Piano di Risanamento Acustico Comunale - asfalto fonoassorbente compreso risanamento del sottofondo - tratto via Senese - REACTEU - cod opera 210290

Quadro economico			
Codice operazione Presente all'interno del Piano operativo	Voci di spesa	Importo (€)	Note
FI_6.1.4g	Progettazione e studi		
	Acquisizione aree o immobili		
	Lavori	363.362,00	
	Oneri di sicurezza	11.238,00	
	Servizi di consulenza	25.475,52	Servizi di Ingegneria e Architettura (con IVA)
	Interferenze		
	Imprevisti	5.237,74	(con IVA)
	IVA su lavori e oneri di sicurezza 10%		
	IVA residua	82.412,00	22% su lavori e oneri sicurezza
	Oneri di investimento		
	Lavori a carico del concessionario		
	Oneri di sicurezza a carico del concessionario		
	Altro	12.274,73	Comprende gli incentivi per funzioni tecniche ex art. 113 D.lgs 50/2016, rilievi ed indagini, spese allacciamenti e varie (con IVA)
	TOTALE	500.000,0	

Completamento del Piano di Risanamento Acustico Comunale - asfalto fonoassorbente compreso risanamento del sottofondo - tratto via Bolognese - REACTEU - cod opera 210291

Quadro economico			
Codice operazione Presente all'interno del Piano operativo	Voci di spesa	Importo (€)	Note
FI_6.1.4g	Progettazione e studi		
	Acquisizione aree o immobili		
	Lavori	363.362,00	
	Oneri di sicurezza	11.238,00	
	Servizi di consulenza	25.475,52	Servizi di Ingegneria e Architettura (con IVA)
	Interferenze		
	Imprevisti	5.237,74	(con IVA)
	IVA su lavori e oneri di sicurezza 10%		
	IVA residua	82.412,00	22% su lavori e oneri sicurezza
	Oneri di investimento		
	Lavori a carico del concessionario		
	Oneri di sicurezza a carico del concessionario		
	Altro	12.274,73	Comprende gli incentivi per funzioni tecniche ex art. 113 D.lgs 50/2016, rilievi ed indagini, spese allacciamenti e varie (con IVA)
	TOTALE	500.000,0	

Completamento del Piano di Risanamento Acustico Comunale - pavimentazioni fonoassorbenti via delle Cascine, via Paisiello, via delle Porte Nuove, via del Ponte alle Mosse

Quadro economico			
Codice operazione Presente all'interno del Piano operativo	Voci di spesa	Importo (€)	Note
FI_	Progettazione e studi		
	Acquisizione aree o immobili		
	Lavori	492.366,82	
	Oneri di sicurezza	25.914,04	
	Servizi di consulenza	20.346,61	Servizi di Ingegneria e Architettura (con IVA)
	Interferenze		
	Imprevisti	5.000,00	(con IVA)
	IVA su lavori e oneri di sicurezza 10%		
	IVA residua	114.021,79	22% su lavori e oneri sicurezza
	Oneri di investimento		
	Lavori a carico del concessionario		
	Oneri di sicurezza a carico del concessionario		
	Altro	10.065,02	Comprende gli incentivi per funzioni tecniche ex art. 113 D.lgs 50/2016, rilievi ed indagini, spese allacciamenti e varie (con IVA)
	TOTALE	667.714,29	

ACTION B8

Expected results under Action B8:

After the project's conclusion, FIRENZE will lay the new pavement for at least 500 m in 3 different sites in five years.

✓   confirmed by the Municipality

Transferability of solution in other Countries/contexts

In terms of transferability, the proposed solution can be transferred in other contexts, characterized by different climatic conditions, by the optimization and adaptation of the mixtures used in the pilot area. It is foreseen 1 implementation in a different context within 3 years after the project's end (UNIRC-UGE).

No specific contribution on this aspect

Follow-up market oriented

UNIRC will aim at patenting the set-up solutions and at creating a start-up or spin-off to commercialize the technology to which possibly also I-POOL will participate. This process will begin just after the project's conclusion and this is going to be a strong partnership in terms of access to French, Italian and international markets.
To this end, a market study and a business plan will be prepared.
The transferability to other geographical areas will be guaranteed considering that the test site will be in France and the pilot one in Italy.
The pavement design concept will have general characteristics independent from the national products.

RT2) FESTIVALS AND EVENTS REPLICATION ✓

During the project lifetime **1 initiative will be proposed in Eurocities meetings by FIRENZE** involving at least 25 EU cities.

The LIFE E-VIA PROJECT
has been presented in the Eurocities Environment
Forum of Oslo 23-25 October 2019

21 cities participating:
Bergen, Braga, Bristol, Copenhagen, Florence, Ghent, Guimaraes, Hamburg, Helsinki, Malaga, Mannheim, Mezitli, Milan, Munster, Oslo, Porto, Reims, Strasbourg, Turin, Varna and Zaragoza.

AGENDA WORKING GROUP NOISE EUROCITIES
VERSION 1.7

WD 03.1

EURO CITIES   City of Oslo

WORKING GROUP NOISE EUROCITIES
Venue of the meeting: Scandic Solli Hotel, Parkveien 68, 0202 Oslo

Wednesday 23 October 2019
Oslo

** The essential working documents are at PM For this you need a username and a password.
These credentials can be obtained via heather.brooks@eurocities.eu

1

	10:30		
	Coffee break and Networking		
5.	11:00	**Subject: Subject:** Round table Projects	WD 5.1 LIFE E- VIA (The relationship between electric vehicles, asphalt and tires) (AM)
		Rapporteur: Mr Enrico Gallo, Mr Arnaldo Melloni, Ms Chiara Bartalucci, all participants	WD 5.2 Noise as a partner of quality of life (SL)
		Expected action: 1. Presentations 2. Sharing views and experiences	
6	12:00	**Subject:** Railway Noise (how BaneNor is working on the rail	WD 06.1 PM

Moreover, after the project's end, at least one more festival will be organised by Florence municipality.
Finally, being Florence a member of Eurocities, training and awareness raising among cities will be guaranteed during the Eurocities meetings. ✓

RT4) CNOSSOS IMPROVED DATA BASE FOR STRATEGIC NOISE MAPPING

Replication and transferability of project output EU policies oriented
During the project's lifetime, once the CNOSSOS database will have been improved for strategic noise mapping by the LIFE E-VIA project, it will be tested in 3 noise maps (VIENROSE, I-POOL).

After the project's end it is expected that the coefficients derived into the project will permit the noise prediction. As a consequence, 3 further applications of the CNOSSOS improved database will be made for strategic mapping.

The database is implemented and the coefficients for electric vehicles and asphalt have been found.
The coefficients were processed and tested on Via Paisiello.
The coefficients will certainly be used in the action plans, as the switch to electric vehicles will certainly be used in the action plans of several managers of public transport, particularly in agglomerations.

If there had been no extension on the deadline of the action plans (originally June 2023, now June 2024), they would have already been used.

RT5) 3 PROJECT-BASED ACTION PLANS

Replication of solution tested in the pilot area

After the project's end, in the frame of the implementation of Action Plans for Agglomerations and Major Roads as indicated in the Environmental Noise Directive 2002/49/EC, VIENROSE will adapt and propose as possible solutions to mitigate noise in the cities and major roads, the ones developed in the frame of the LIFE E-VIA project.

At least three action plans of Italian cities/major roads will test output of LIFE E-VIA project.
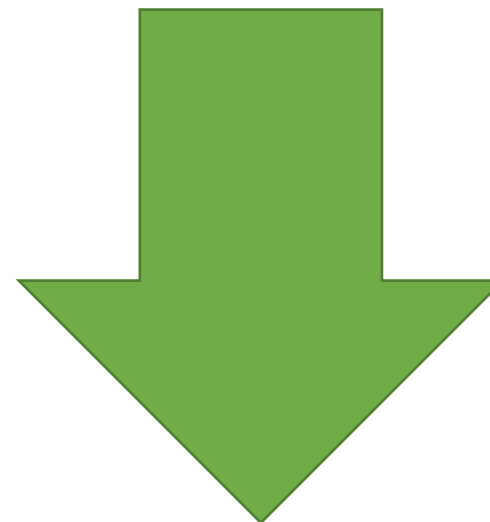
Moreover, the Life E-VIA asphalt was proposed by VIENROSE:

1. in the **Noise action plan of the Comune of Inzago (MI)** and has already been laid and tested with more than satisfactory results in two different road sections.

Section 1

Tabella 2 – Tratti stradali oggetto del Piano d'Azione

Strada Provinciale EX S.S. 11 "Padana Superiore"		
Tratto	Lunghezza [Km]	Tipologia di strada (Codice della Strada, D.L. n. 285 del 1992)
Dal km 168+350 al km 170+850	2,5	F – Strada Locale Cb – extraurbana secondaria

Codifica Scenario di Misura	Periodo di riferimento	L'$_{Aeq}$ [dB(A)]	Attenuazione [dB(A)]
SC01	TR notturno	39,8	5,5
SC02	TR notturno	34,3	
SC03	TR notturno	40,9	4,5
SC04	TR notturno	36,4	

Section 2

Codifica Scenario di Misura	Periodo di riferimento	L'$_{Aeq}$ [dB(A)]	Attenuazione [dB(A)]
SC01 (2021)	TR notturno	34.4	5.3
SC01 (2020)	TR notturno	39.8	

2. In the **Noise action plan of Livorno Province main roads**

**Results already presented
during the last monitoring visit!**

MOREOVER.....

Life E-VIA asphalt was proposed by VIENROSE:

3. in the **Noise action plan of the Comune of Inzago (MI)** and has already been laid and will be tested before the end of the project in a third road section.

4. Has been proposed as a standard reference for the Piano Triennale di Bonifica dell'inquinamento acustico of Regione Lombardia

Regione Lombardia

MANDATARIO

MANDANTI

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PIANO REGIONALE TRIENNALE DI BONIFICA
DELL'INQUINAMENTO ACUSTICO

RT6) CR-BASED PAVEMENTS
Replication and transferability of project output
Based on the received letters of interest, three CR (crumb-rubber) CR-based pavement initiatives will be carried out by Ecopneus after the project's conclusion. This is going to further boost the replicability of the actions and results of the project. Ecopneus, in the Italian context, will promote the results among public and private infrastructures' owners; Tuscany and Calabria regions will hopefully test and implement the solutions developed in the project on the infrastructures located on their territories.

Ecopneus is a partner in the LIFE SNEAK project together with the Municipality of Florence, the University of Reggio Calabria and Vienrose. In this context, optimised asphalts are being tested for urban areas where the presence of vibrations is relevant.
Three dissemination events are planned within the LIFE SNEAK project: in all these events Ecopneus will also promote the results of the E-VIA project, in which the optimised asphalt laid in the pilot area contained a part of recycled rubber powder.

ACTION E1

Activities planned under Action E1:
6 general meetings ✓

**Results already presented
during the last monitoring visit!** →

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

MOREOVER….. →

Progress of project activities and preparation of final event	**20 July 2022**	**Online**	**ALL**

Monitoring reports on a semester base ✓

Monitoring reports on a semester base

GO-NOGO monitoring sheet	ONGOING						
Action (number and title)	INFORMATION AND AWARENESS RAISING ACTIVITIES						
Beneficiary responsible for Action implementation (Name, Surname, Partner affiliation)		VIENROSE					
GENERAL MONITORING		INSERT VALUE	GO	NOGO		Soglie	
Compliance with action objectives	Percentage	75				75	VERO
Compliance with action deadline	Number of days of delay	0				15	VERO
Produced deliverables	Percentage	85				75	VERO
Problems encountered and actions foreseen to cope with them			No major problems for the moment				
FINAL JUDGEMENT (Put an X in correspondence of the GO/NOGO cell)	Positive		GO	NOGO	CORRECTIVE ACTIONS		
Problems/Warnings/Risks/Necessary corrections							
Deadline for reviewing/making corrections		Date of performed review					
Monitoring sheet filled by (Name, Surname, Partner affiliation)							
Date	30/06/2022						
		ARNALDO MELLONI					
Signature	Arnaldo Melloni						

E1's PROJECT DELIVERABLE PRODUCTS

Deliverable name	Deadline	
Monitoring protocol	09/2019	✔
Final project report	01/2023	✔

E1's PROJECT MILESTONES

Milestone name	Deadline	
Project kick off/nomination of Committees	10/2019	✔
Final event	01/2023	✔

ACTION E2

The structure of the after-life plan is being prepared

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LIFE E-VIA

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

www.life-evia.eu

**LIFE E-VIA PROJECT
Monitoring visit 5TH December 2022 - Firenze**

Comune di Firenze

Responsible for actions B3, B8, E1, E2

Iacopo Bianchi, Cecilia Cantini, **Arnaldo Melloni,** Gessica Pecchioni, Ilaria Nasti

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LIFE E-VIA

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

www.life-evia.eu

**LIFE E-VIA PROJECT
Monitoring visit 5TH December 2022 - Firenze**

**Vienrose Ingegneria
Responsible for actions B5, D1, D2**

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

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ACTION B5

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 (bus) concerning passage on different road pavements

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

Results already presented
during the last monitoring visit!

112 collected questionnaires vs
100 expected

ACTION B5.1

Soundwalks – introduction and methods

Holistic soundscape approach

External noise

Soundwalks in the project pilot street and the surrounding area

5 locations selected as listening points
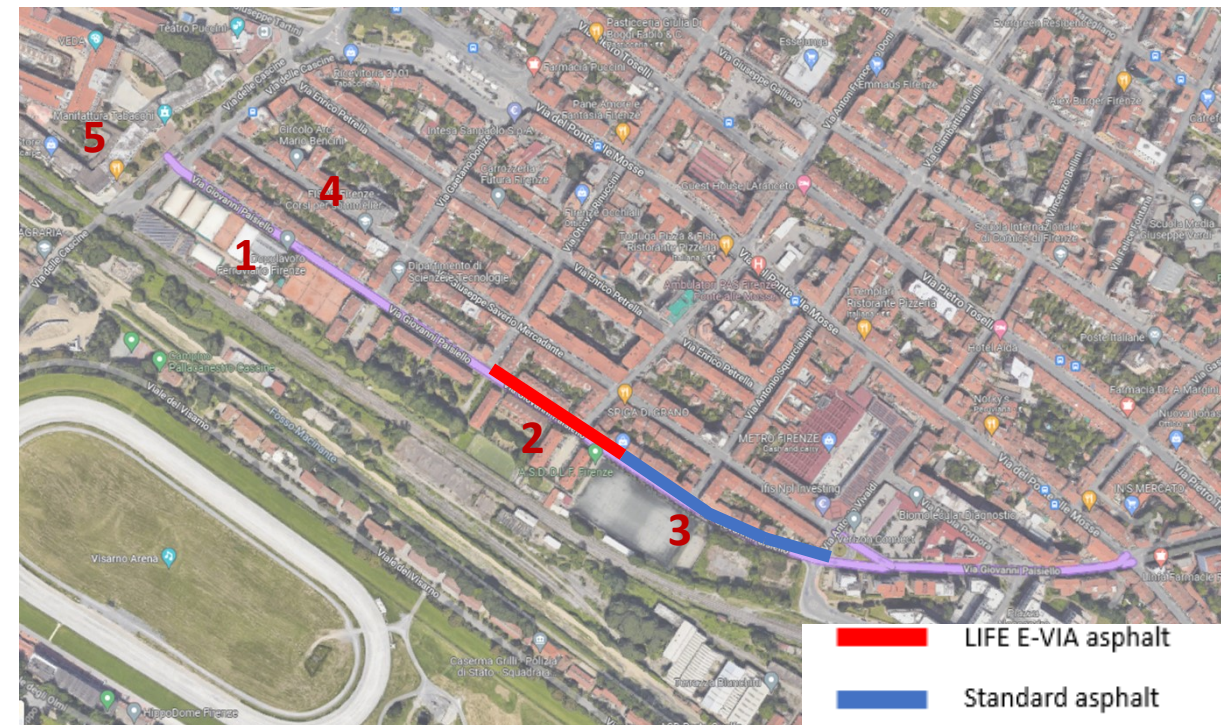
Internal noise

Audio recordings:
1. Inside an ICEV – Optimized Asphalt
2. Inside an EV – Optimized Asphalt
3. Inside an EV – New but standard Asphalt
4. Inside an ICEV – New but standard Asphalt

Soundwalks – introduction and methods

➢ Design of the questionnaires to assess participants' perception of the soundscape and evaluate the benefits of the LIFE E-VIA intervention (optimized asphalt)

➢ Communication/Dissemination actions carried out to engage participants (leaflets, emails, posts on Vie en.ro.se social networks)

Soundwalks – methods

From April to November 2022: 7 soundwalks were carried out - groups of 10-13 people
Total 80 participants vs 150 expected

| Ear cleaning exercises | → | Soundwalk experience with 5 listening points | → | Audio recordings |

Questionnaire

Soundwalks

Ear cleaning exercises

Objective: training conscious listening and focusing on acoustic perception
Participants are asked to i) focus on and write down different type of sounds (pleasant/unpleasant, close/distant, in motion/static, natural/mechanical/anthropic) and ii) follow a sound source with closed eyes

Close

Tennis ball
Leaves   **Cars**

Distant

Cars **Traffic**
      Voices

Pleasant

Leaves **Anthropic**
       sounds
   Wind

Unpleasant

Traffic noise
Cars
    Motorcycles

In motion

Cars
   Traffic
Voices

Static

Wind **Tennis**
   Air conditioner
   system

Nature sounds:
Wind, leaves

Mechanical sounds:
Traffic noise, cars, air conditioner system

Anthropic sounds:
Voices, steps, tennis ball

Soundwalks – itinerary and recordings
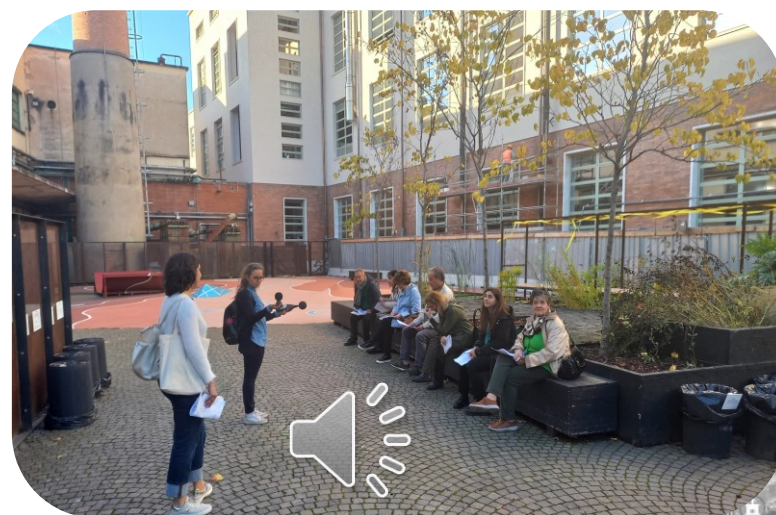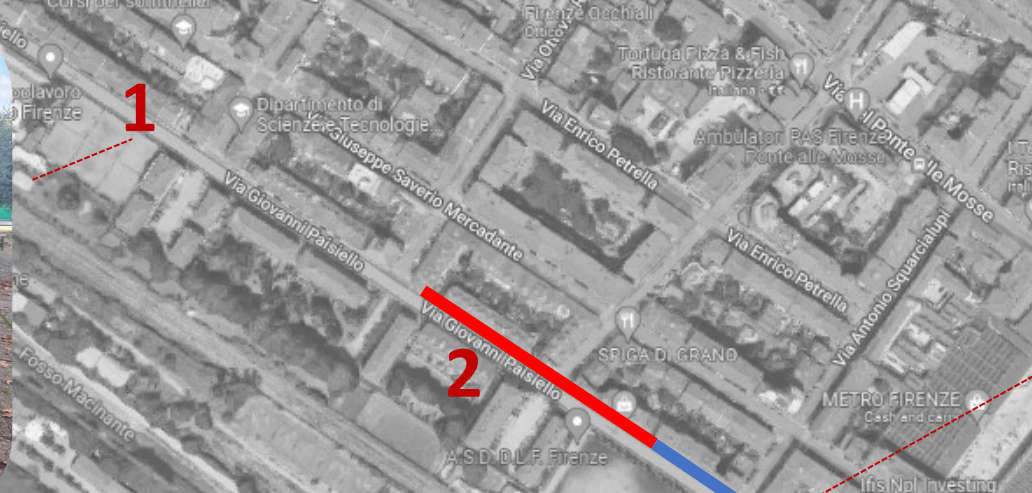
LIFE E-VIA asphalt
Standard asphalt

Soundwalks – interviews' results

Demographic profile

80 participants

- Most represented age groups: 18-25 and 66-77

- Majority of sample composed of students and retired people

- 38% of those who already know the pilot street attends the area everyday (most of them live there), 28% few times a year (e.g. as a transit area), 24% once a week (e.g. for leisure activities at sport facilities)


AGE

- 18-25
- 26-40
- 41-55
- 56-65
- 66-75
- >75

0% · 26% · 20% · 17% · 13% · 24%

OCCUPATION

- EMPLOYEE
- SELF EMPLOYED
- RETIRED
- STUDENT
- HOUSEKEEPER
- OTHER
- N/A

20% · 15% · 32% · 28% · 1% · 3% · 1%

ATTENDANCE

- EVERYDAY
- ONCE A WEEK
- TWICE A MONTH
- ONCE A MONTH
- FEW TIMES A YEAR

38% · 24% · 9% · 1% · 28%

REASONS

LEISURE ACTIVITIES
TRANSIT AREA
WORK
RESIDENCE OF ACQUAINTANCES
RESIDENCE/HOME

0 5 10 15 20 25 30
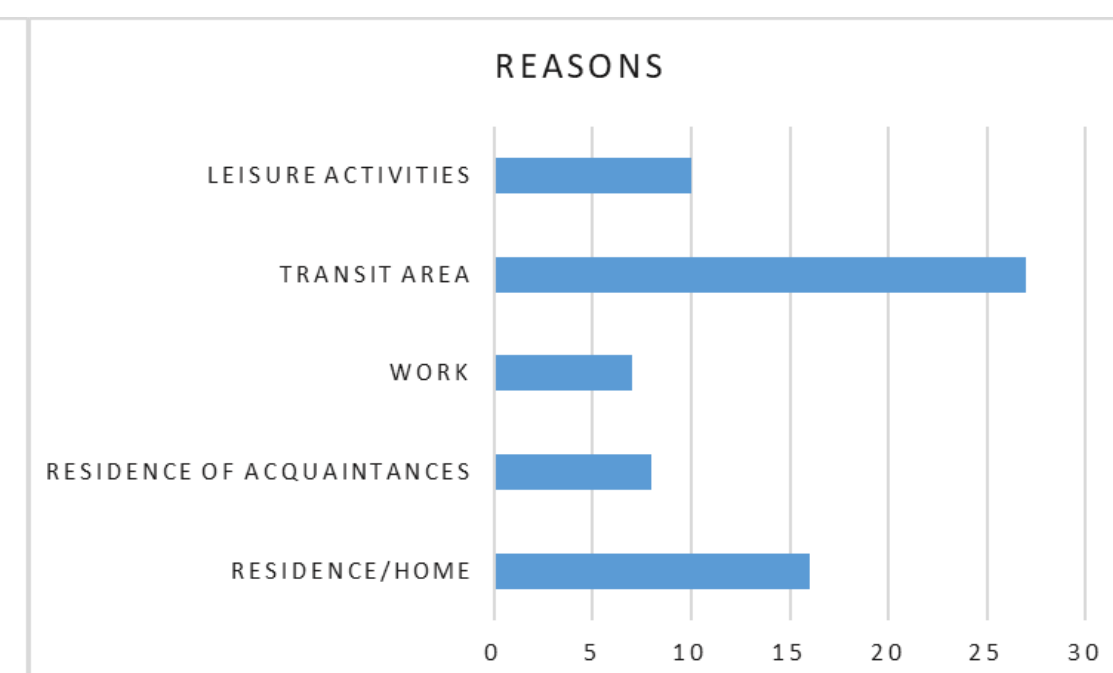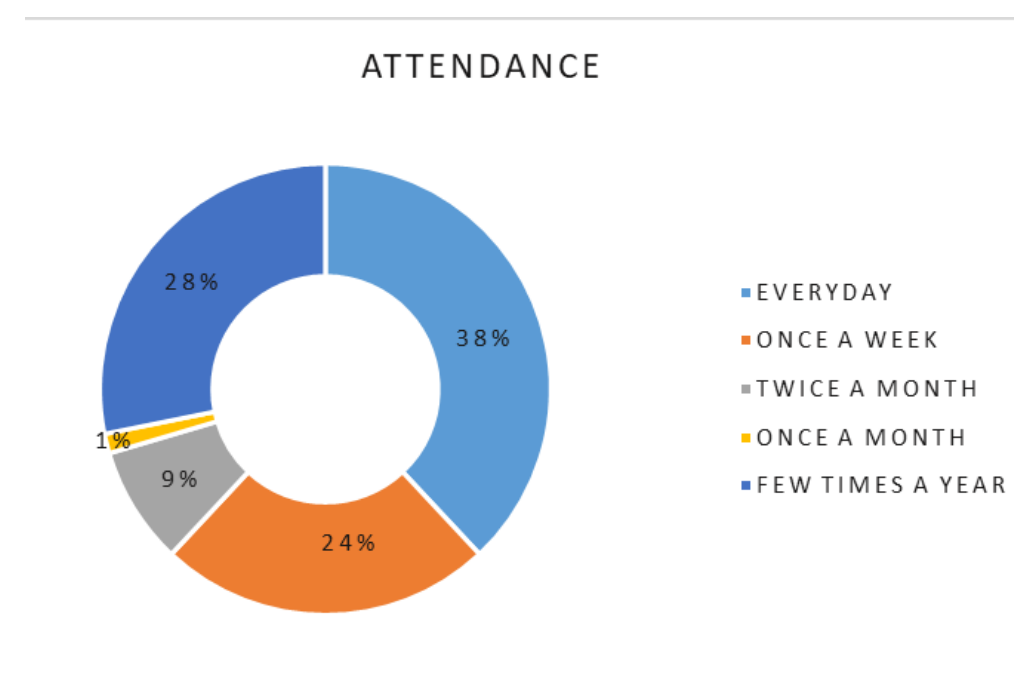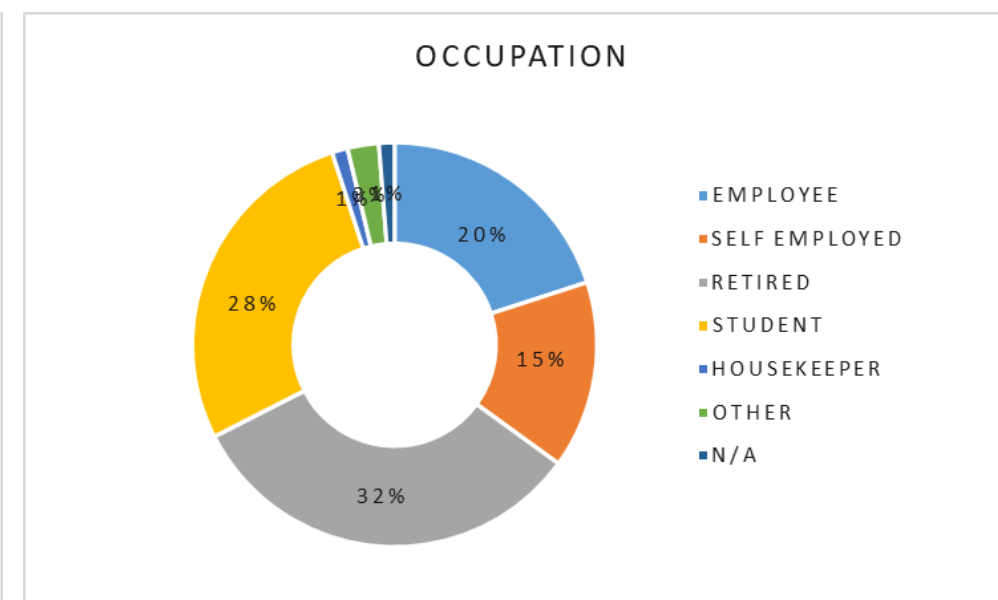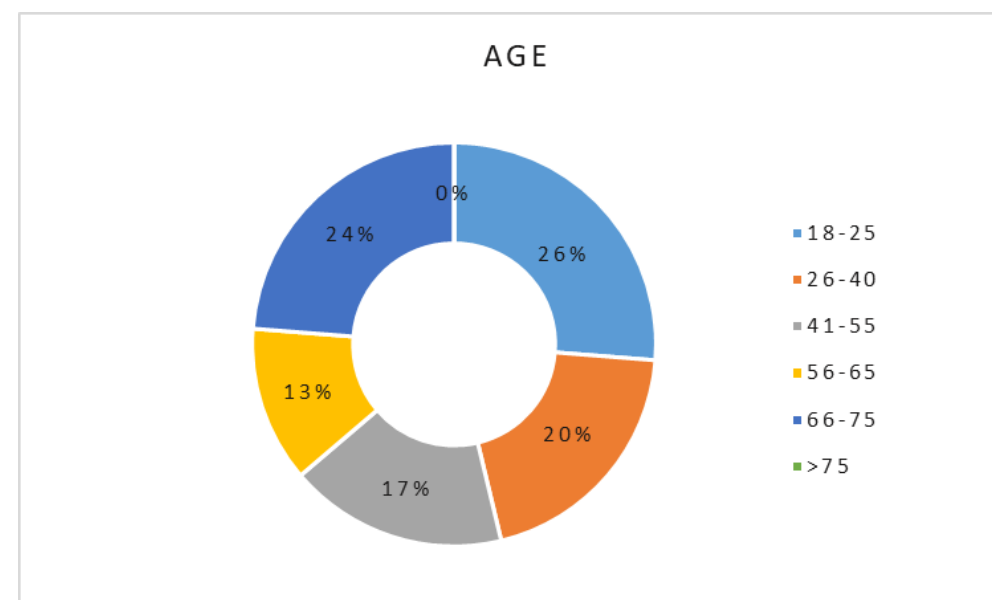
Soundwalks – interviews' results

✓ LP3 is perceived as the most disturbing location; instead LP1 and LP5 are the most enjoyable and relaxing sites in terms of soundscape

✓ As regards sound sources: traffic noise is perceived with a slightly less intensity in LP2 and LP4 than in LP3

These results are reflected in the assessment of the quality of soundscape and landscape:

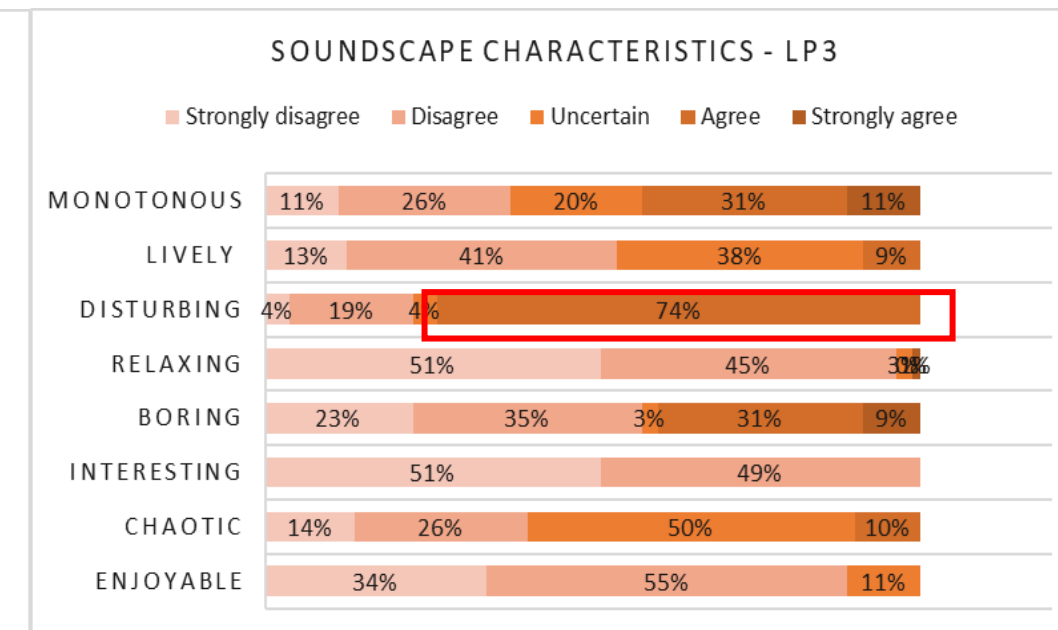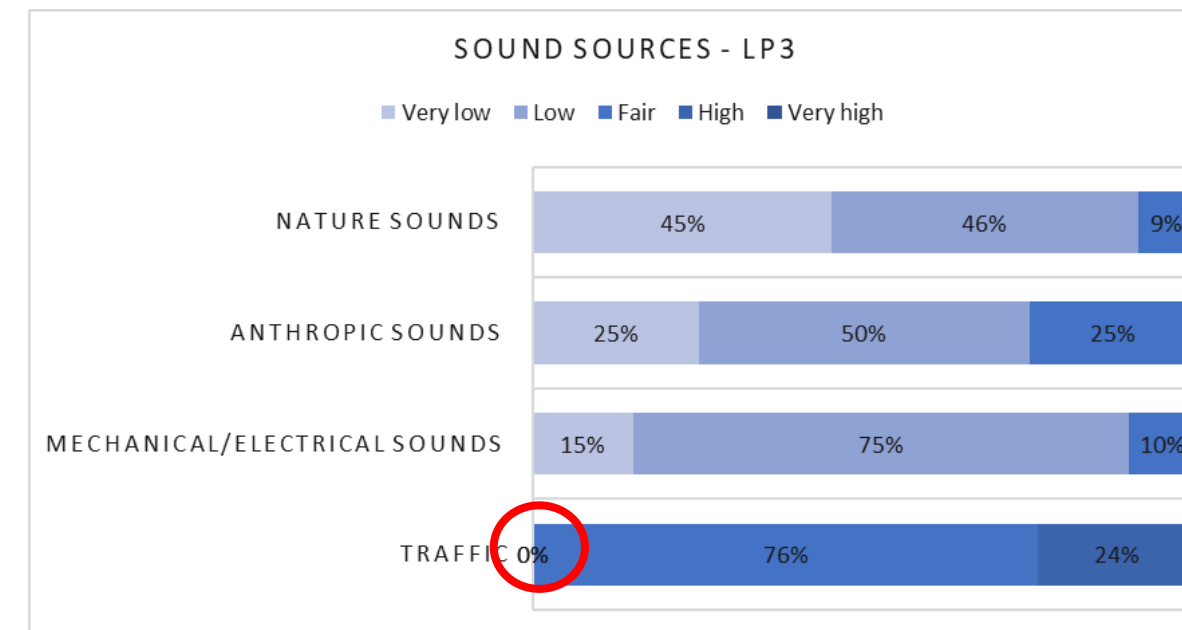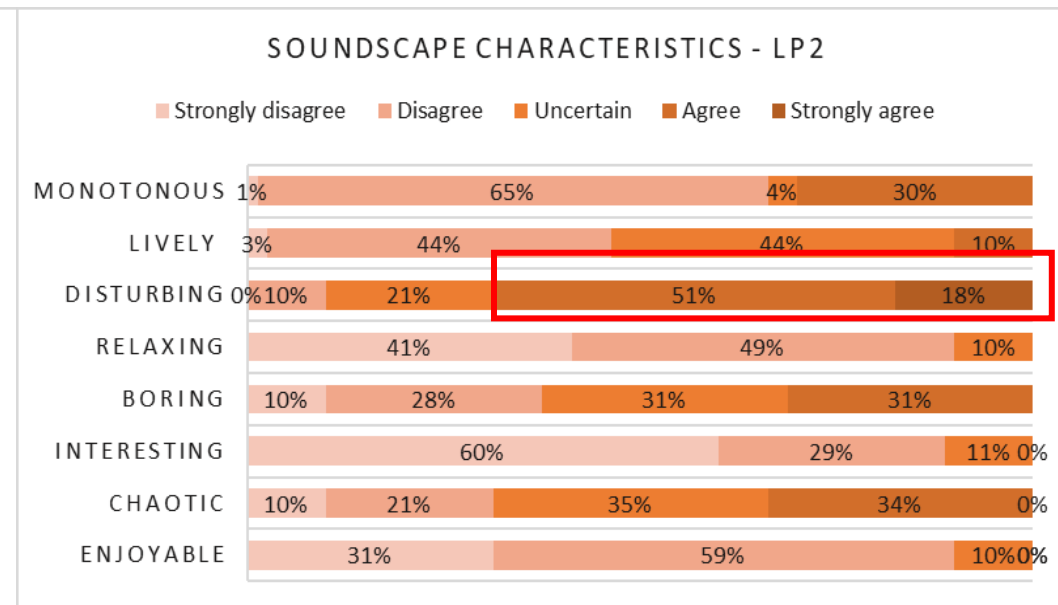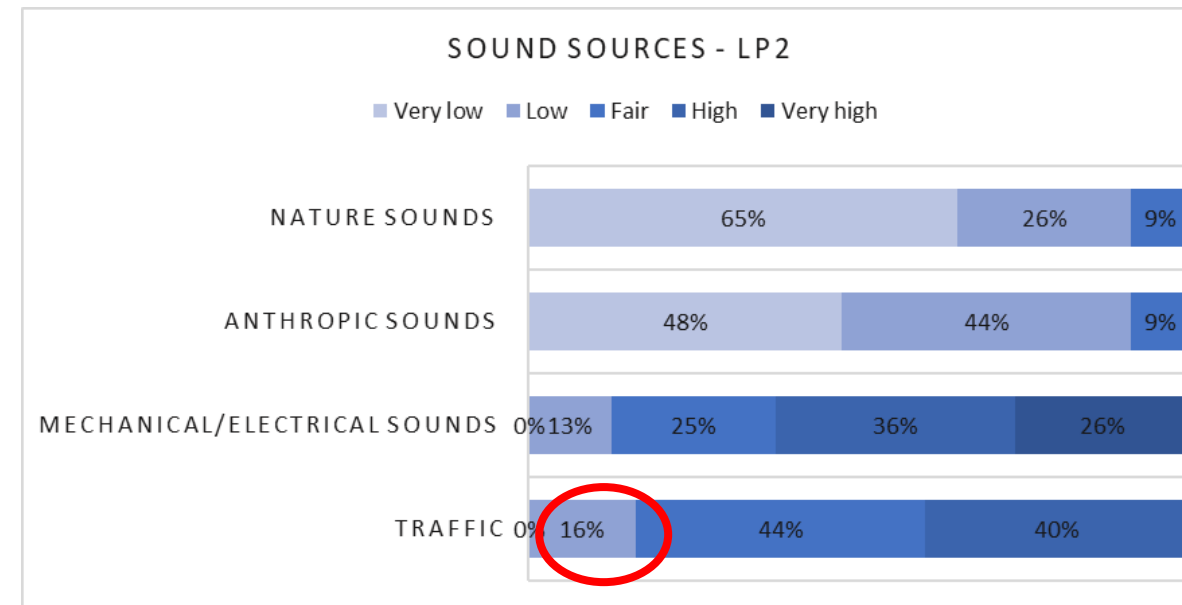✓ the great majority of participants assesses the soundcape quality of LP2 and LP3 with 4-6 values on a 11-scale.
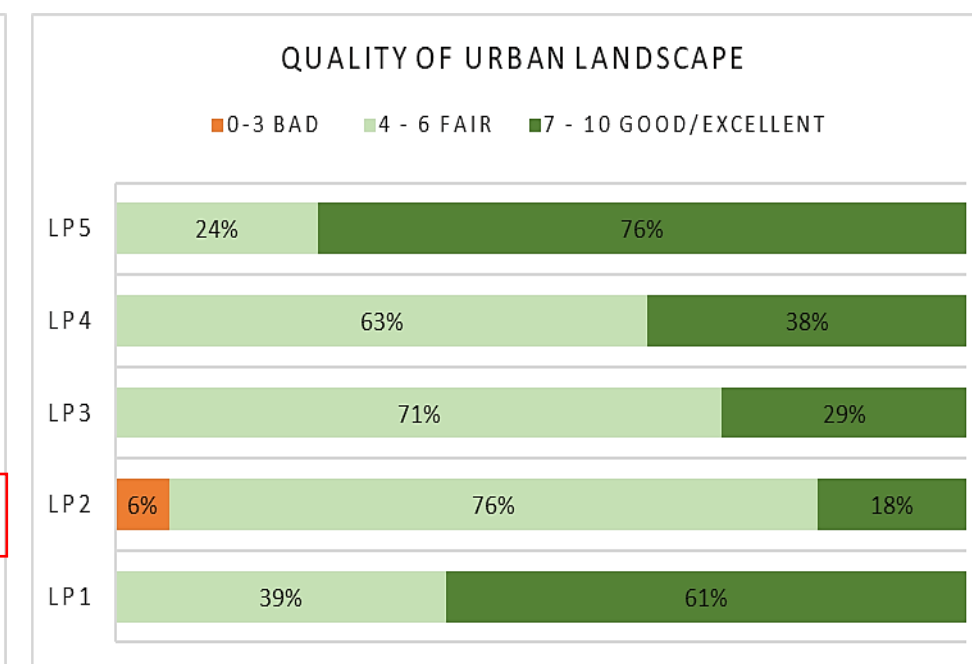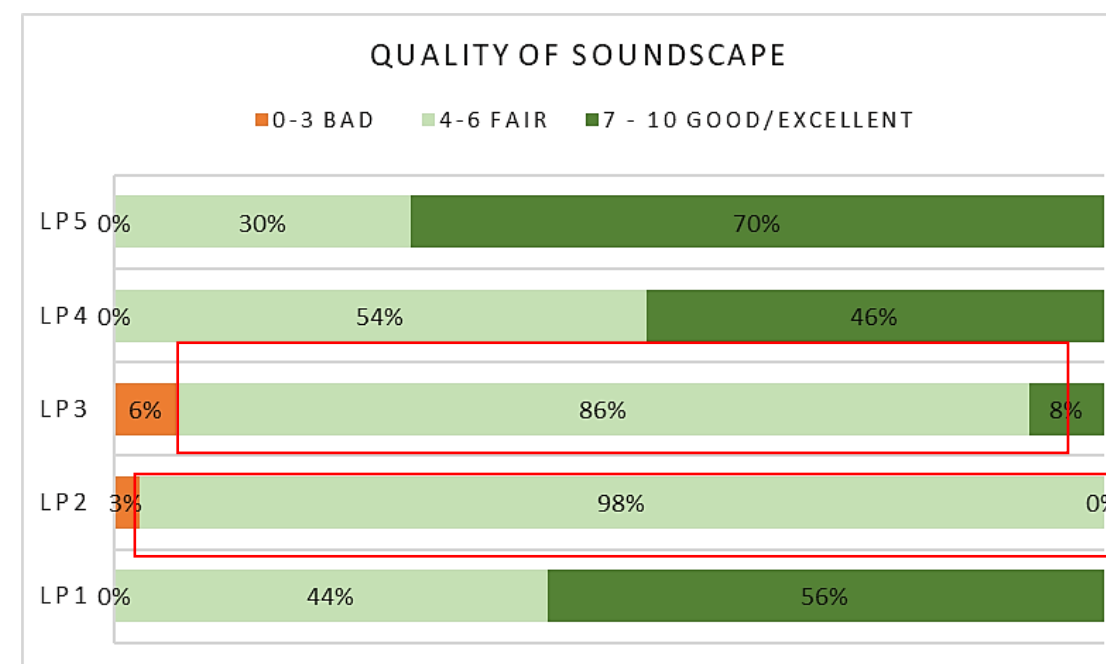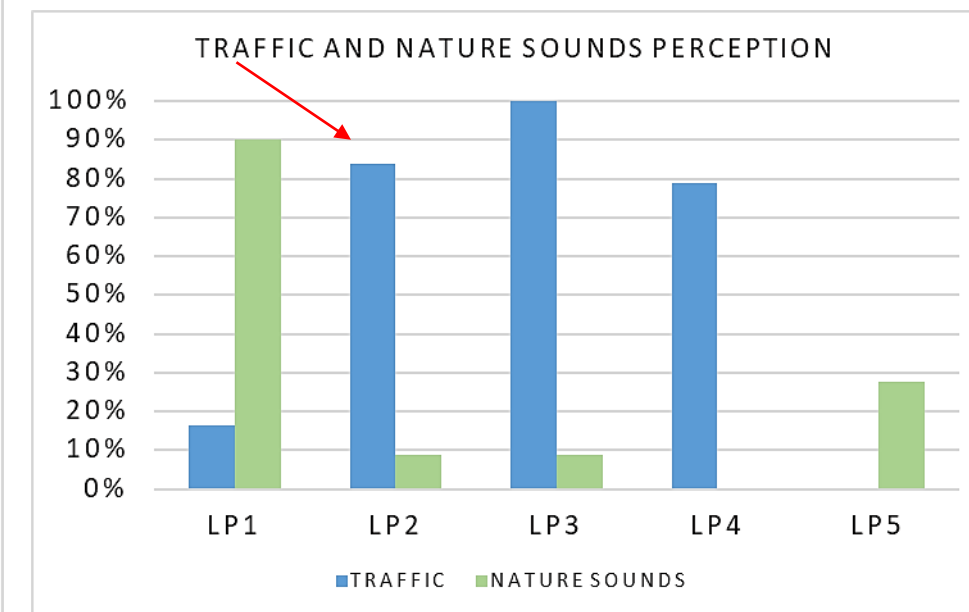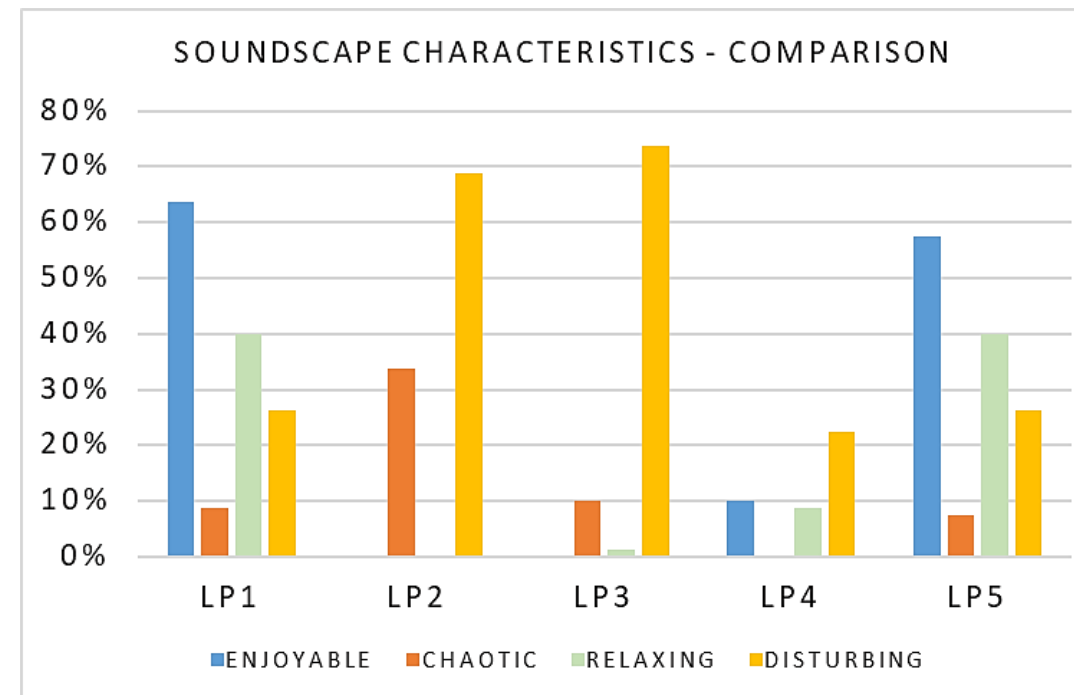
Soundwalks – interviews' results

Comparing more in details participants perception of the soundscape at LP2 (optimized asphalt) and LP3 (new but standard asphalt):

✓ At LP2 **16%** of the subjects perceives **traffic noise as «fair»,** instead, in LP3 all the subjects evaluate it as at least «high»

✓ Soundscape evaluated as **disturbing** (agree/strongly agree):
   • by **69%** at LP2,
   • by **74%** at LP 3

SOUND SOURCES - LP2

Very low | Low | Fair | High | Very high

NATURE SOUNDS	65% / 26% / 9%
ANTHROPIC SOUNDS	48% / 44% / 9%
MECHANICAL/ELECTRICAL SOUNDS	0% 13% / 25% / 36% / 26%
TRAFFIC	0% 16% / 44% / 40%

SOUNDSCAPE CHARACTERISTICS - LP2

Strongly disagree | Disagree | Uncertain | Agree | Strongly agree

MONOTONOUS	1% / 65% / 4% / 30%
LIVELY	3% / 44% / 44% / 10%
DISTURBING	0% 10% / 21% / 51% / 18%
RELAXING	41% / 49% / 10%
BORING	10% / 28% / 31% / 31%
INTERESTING	60% / 29% / 11% 0%
CHAOTIC	10% / 21% / 35% / 34% / 0%
ENJOYABLE	31% / 59% / 10% 0%

SOUND SOURCES - LP3

Very low | Low | Fair | High | Very high

NATURE SOUNDS	45% / 46% / 9%
ANTHROPIC SOUNDS	25% / 50% / 25%
MECHANICAL/ELECTRICAL SOUNDS	15% / 75% / 10%
TRAFFIC	0% / 76% / 24%

SOUNDSCAPE CHARACTERISTICS - LP3

Strongly disagree | Disagree | Uncertain | Agree | Strongly agree

MONOTONOUS	11% / 26% / 20% / 31% / 11%
LIVELY	13% / 41% / 38% / 9%
DISTURBING	4% / 19% / 4% / 74%
RELAXING	51% / 45% / 3% 1%
BORING	23% / 35% / 3% / 31% / 9%
INTERESTING	51% / 49%
CHAOTIC	14% / 26% / 50% / 10%
ENJOYABLE	34% / 55% / 11%

Soundwalks – noise measurements

During the phase in which the participants were left to listen in silence to the surrounding soundscape (3-4 minutes), **acoustic measurements** and **audio recordings** were also carried out.

The processing of the acoustic measurements made it possible to evaluate the consistency between the subjective and objective acoustic assessment:

Quality of soundscape (questionnaire)

LP3	LP2	LP5	LP1	LP4

Measured noise level (LAeq dBA)

LP3	LP2	LP4	LP1	LP5
65.9	64.0	58.0	51.1	50.7

Audio Recordings – interviews' results

To evaluate *internal noise*, participants were asked to listen to 4 audio recordings, imagining to be passengers of an ICEV and of an EV passing through the two types of asphalt pavements and to assess soundscape quality.

30% of the subjects evaluated the soundscape inside an **EV passing on the optimized asphalt as "good"** while the percentage is just **10% as regards** the standard asphalt inside an ICEV and inside an EV.

The recording of the passage on the optimized asphalt inside an ICEV is perceived as the worst one, suggesting the relevance of noise produced by an ICEV engine.
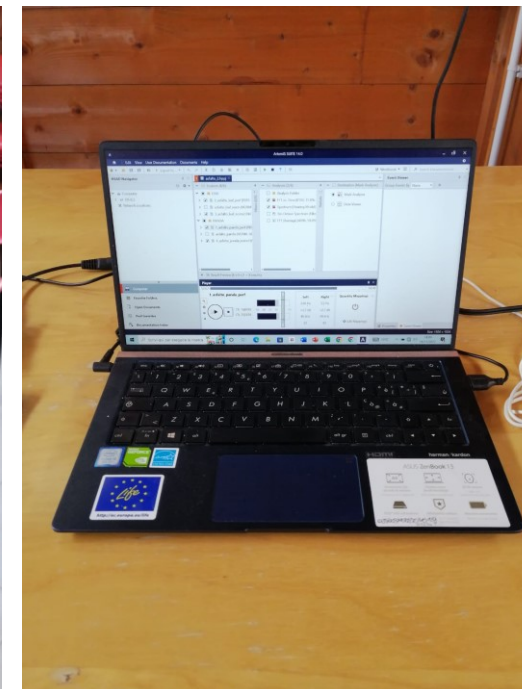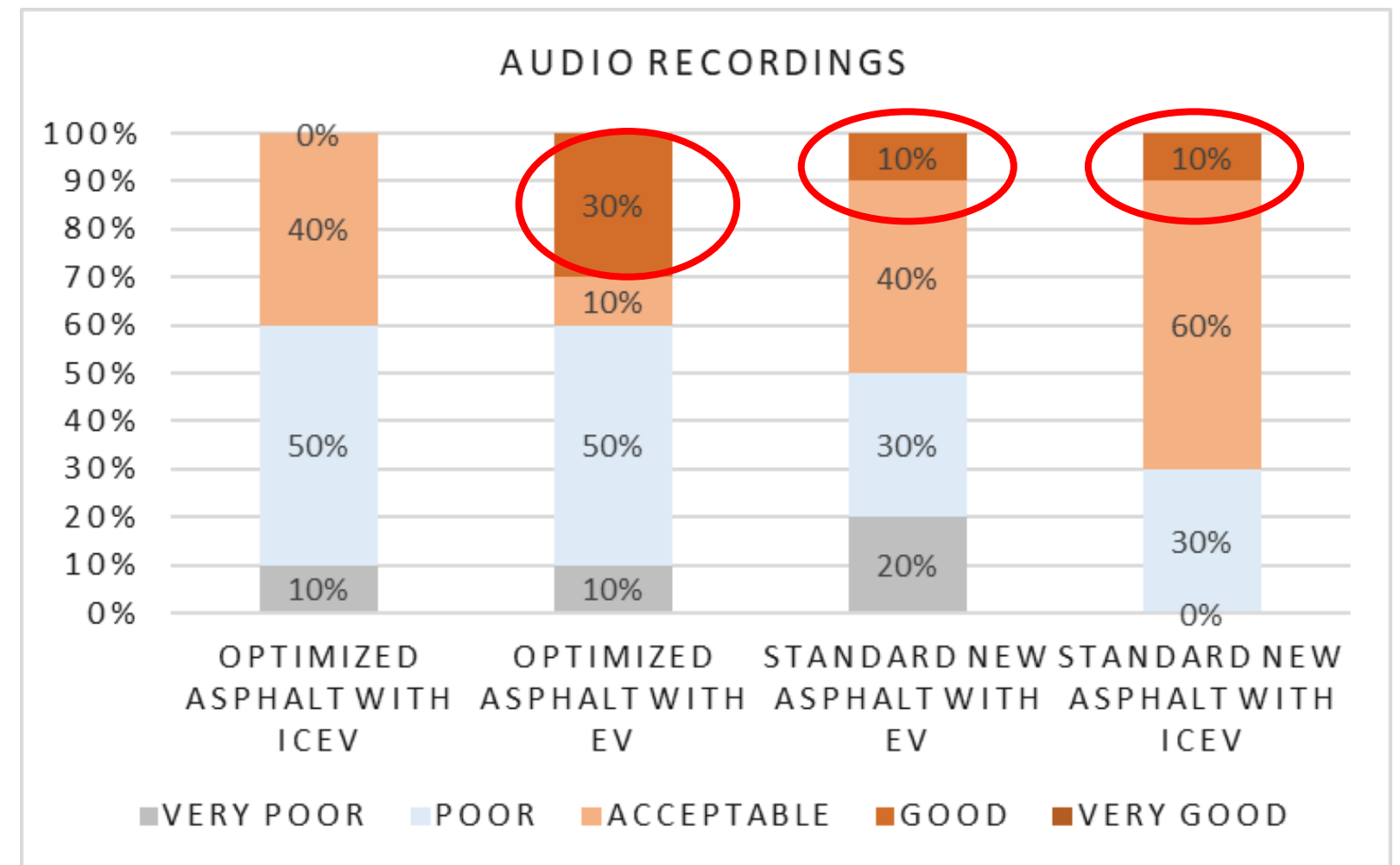
AUDIO RECORDINGS

ACTION B5.2

Interview on EV concerning different road pavements–results

The participants to the soundwalks also did a brief trip on an electric taxi (Nissan Leaf) that was rented to carry out the experience

Participants were asked to evaluate the soundscape while passing through the sections of the pilot area with:

1. LIFE E-VIA optimized asphalt
2. New but standard asphalt
3. Old asphalt

70% of the sample indicate the LIFE – EVIA optimized asphalt as the one with the best performance in terms of the perceived soundscape quality inside the EV

Taxi driver : «While passing through the optimized asphalt I perceived a quieter sound environment and a smooth feeling»

Life E-VIA asphalt
Standard new asphalt
Old asphalt
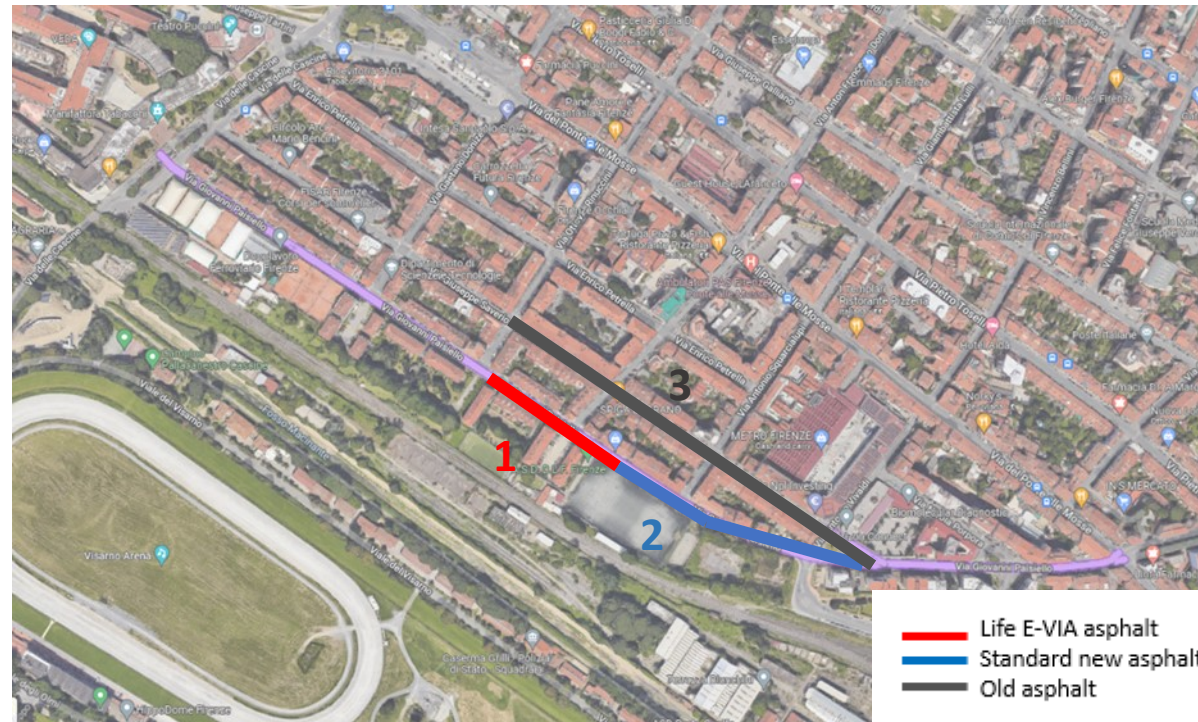
ASPHALT WITH THE BEST PERFORMANCE

STANDARD BUT NEW 30%

OLD 0%

OPTIMIZED 70%

■ OPTIMIZED   ■ STANDARD BUT NEW   ■ OLD
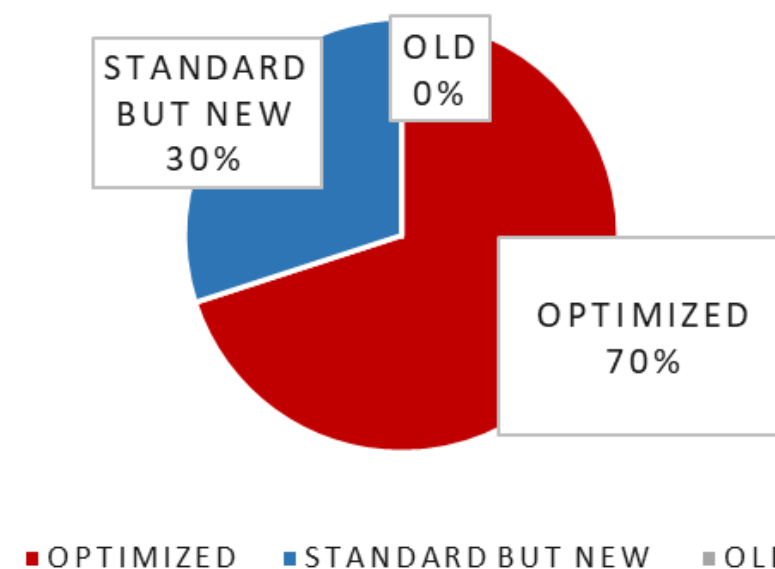
80 participants
vs
150 expected

Report on Action B5

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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.

Moreover, a **long-term post- noise monitoring campaign** has been carried out after about 16 months from the laying.
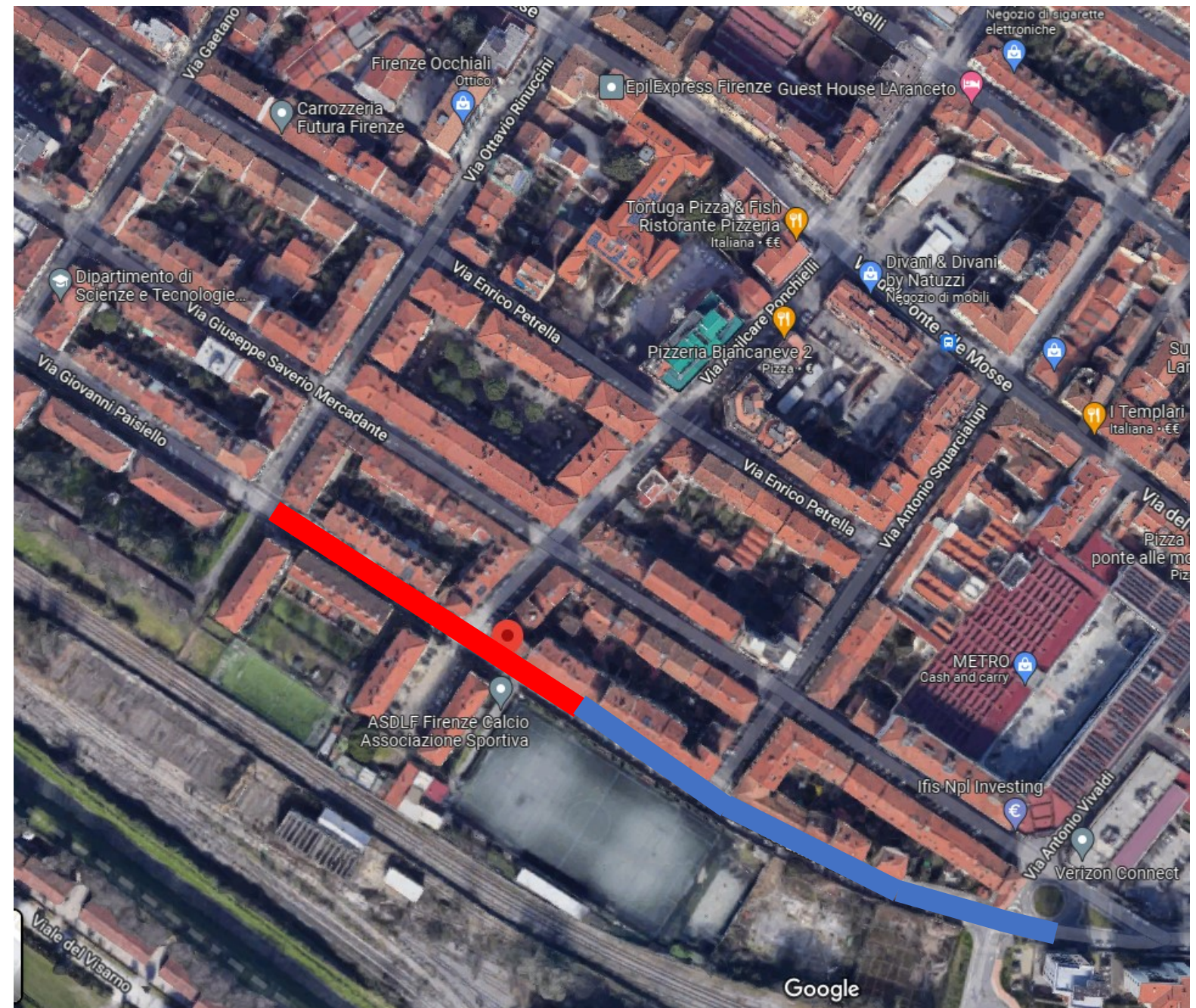
▬▬▬ LIFE E-VIA asphalt

▬▬▬ 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

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

II post-operam campaign carried out by I-POOL
Period: 21st – 30th November 2022

Ante and post-operam noise measurements campaign – data analysis

For the three 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	Lnight
Leq (ante-post)	4,4
Leq (post-post_long term)	2,9

New but standard asphalt	Lnight
Leq (ante-post)	1,5
Leq (post-post_long term)	0,3

Levels of performance are in line with expectations.

ACTION C1

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).

Last updating:
November 2022

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
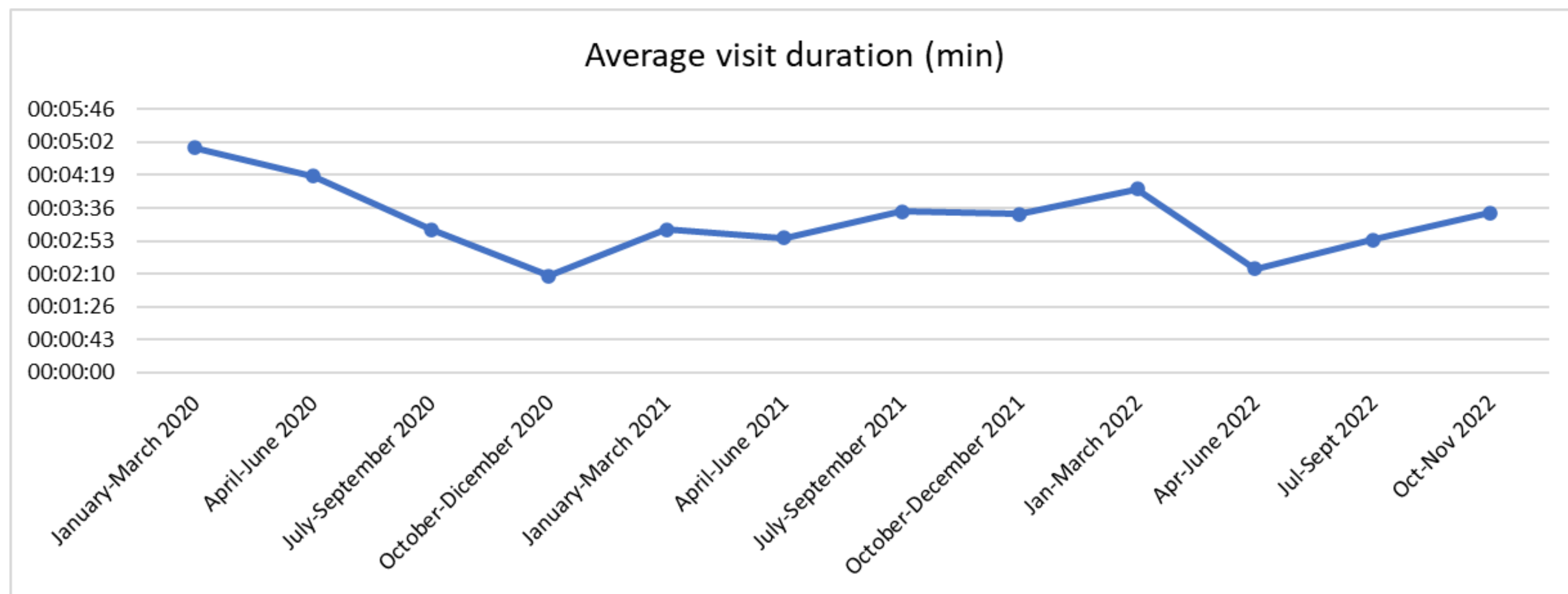- typology of device used by visitors to connect
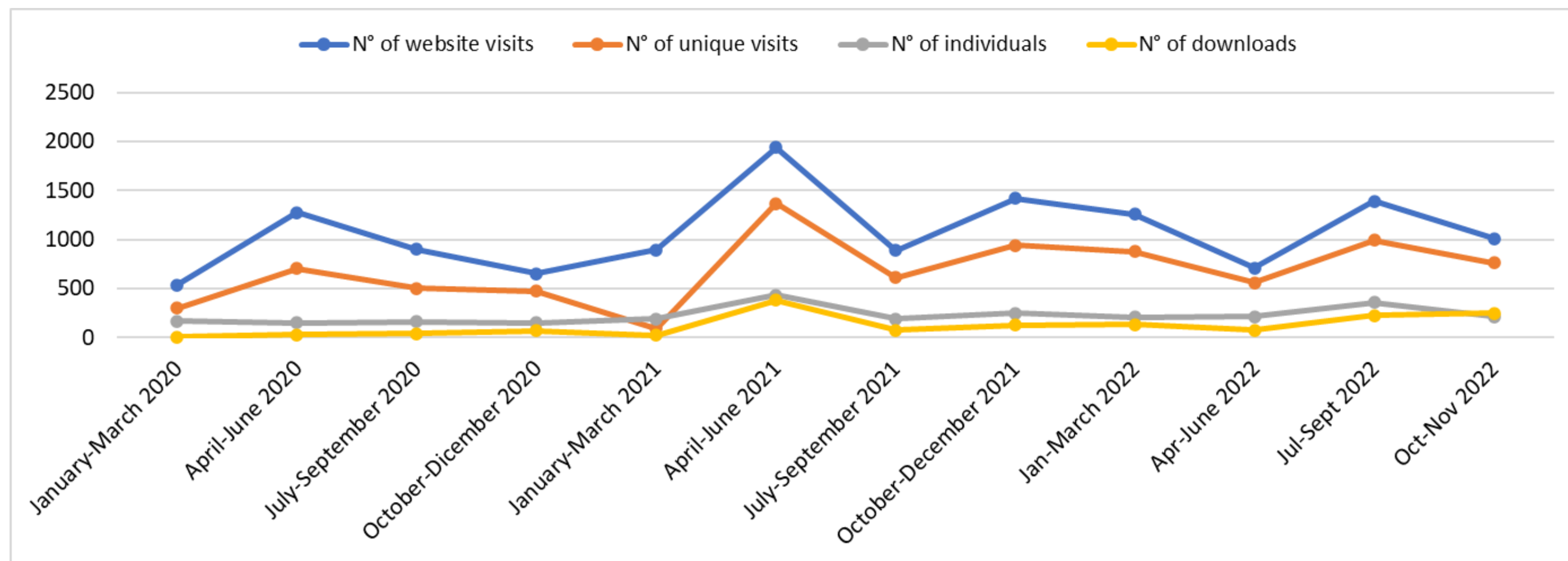
Report on statistics on Website visits

Report on statistics on Website visits

Average visit duration (min)

Report on statistics on Website visits

Some additional indicators

Map of Countries of origin of the connected devices
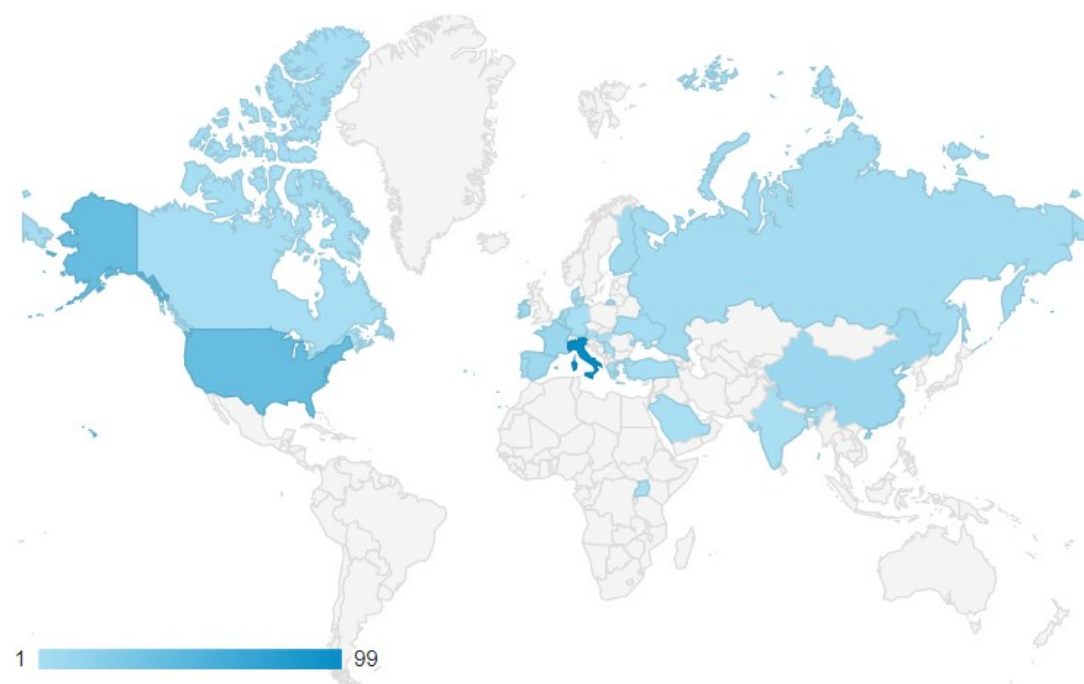
Percentage of direct vs indirect connections

Top Channels

- Direct
- Organic Search
- Social
- Referral

7%

8.6%

21.4%

63.1%
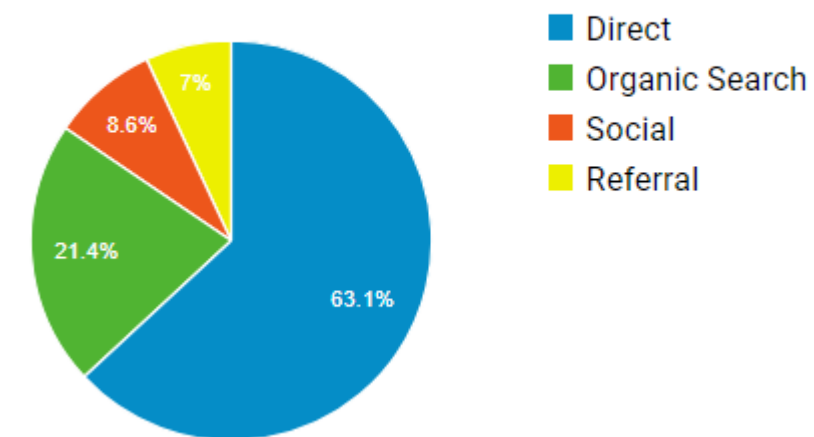
Percentage of New visitors vs Returning visitors

Trend of website visits

Users vs Select a metric

Hourly | Day | Week | Month

Users

30

20

10

November 2022

- New Visitor
- Returning Visitor
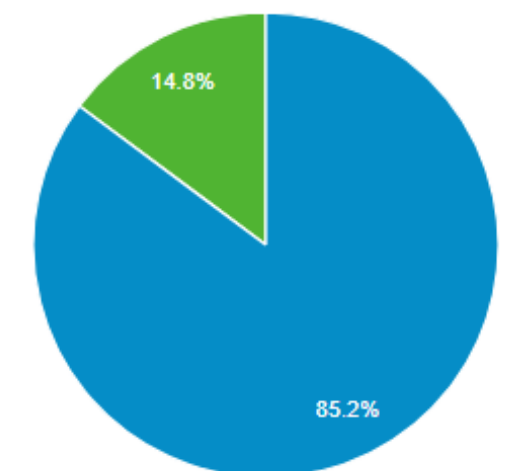
14.8%

85.2%

Social networks

Facebook page: 135 followers – 47 post (period 1/7/2020-30/11/2022)
LinkedIn account: 46 followers – 48 post (period 1/7/2020-30/11/2022)

Statistics on social networks

Period January 2020-December 2020 vs January 2021-November 2022

Sessions: **220.02%**

3,053 vs 954

Sessions via Social Referral: **272.94%**

317 vs 85

Social Network	Sessions
1. Facebook	
1 Jan 2021 - 30 Nov 2022	211
1 Jan 2020 - 31 Dec 2020	71
% Change	197.18%
2. LinkedIn	
1 Jan 2021 - 30 Nov 2022	97
1 Jan 2020 - 31 Dec 2020	10
% Change	870.00%

3. Twitter	
1 Jan 2021 - 30 Nov 2022	7
1 Jan 2020 - 31 Dec 2020	4
% Change	75.00%
4. YouTube	
1 Jan 2021 - 30 Nov 2022	2
1 Jan 2020 - 31 Dec 2020	0
% Change	100.00%

Statistics on social networks

Period January 2020-December 2020 vs January 2021-November 2022

1 Jan 2021 - 30 Nov 2022: ● Sessions via Social Referral
1 Jan 2020 - 31 Dec 2020: ● Sessions via Social Referral

15
10
5
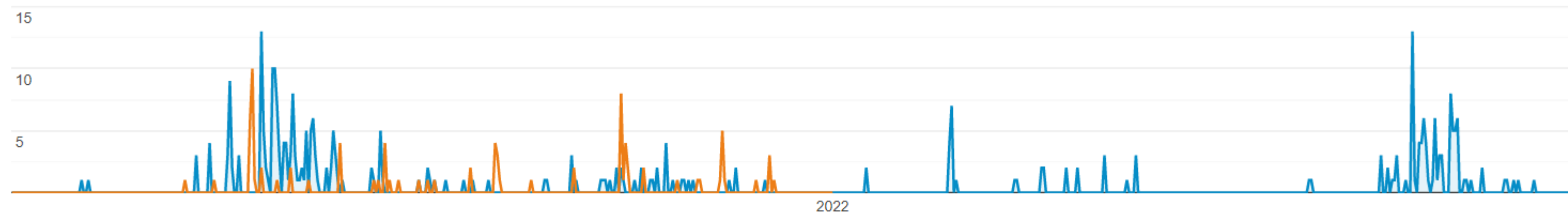
2022

1 Jan 2021 - 30 Nov 2022: ● All Sessions
1 Jan 2020 - 31 Dec 2020: ● All Sessions

100
50

2022

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%	150000	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, 80 participants to the soundwalks who have been informed about the project, 70 (online and in presence) participants to the final event, participants to congresses where the project has been presented.
	Number of website's visits	70000		12881	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	- 5.0 dBA	-	-4.4 dBA	
	Reduction of LCPX in Firenze	90 dBA	-	87.5 dBA ± 1.5	

LIFE E-VIA project indicators updating

Objective	Indicators	Estimated Impact (absolute values)	Estimated Impact (in %)	Notes
Reduction of greenhouse gas emissions (GHG)	CO_2	reduction of 3 tons / year	%reduction of 3%	This is due to the progressive transition towards EVs and hybrid vehicles in the Italian context (cf. text of the proposal) and to the use of improved tyres. Based on data, this trend was different than expected.
Air quality and emissions	PM	reduction of 400 grams / year	% reduction of 5%	This is due to the progressive transition towards EVs in the Italian context. Such a transition is quite slow based on ACI statistics (https://opv.aci.it/WEBDMCircolante/)
Waste management	tyres	0.2 tons per year	Not evaluable	Recycling of CR into the friction course. Main assumptions: 1) desity and percentage of CR and tyres. 2) Lenghts as per project poposal. 3) Tyre type: common in commerce.
	Landfills saved	15 m^3 per each mainteinance cycle	Not evaluable	Recycling of CR into the friction course. This is due to the fact that tires occupy large volumes in landfills
Reduced resource consumption (excluding energy)	Mineral aggregates	0.4 tons/year	Not evaluable	This is due to the use of crumb rubber in friction course mixture. The derivation of this value depends on the following baseline: HMA, CR, and aggregate density, dimensions, CR percentage (w/w).

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 length has been calculated 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 realised and which are already planned After the three replication interventions, the value «beyond end» could be increased Current status: 3 replication interventions are planned
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 Current status: 3 replication interventions are planned
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 Current status: 25 (Università di Ferrara, Università di Genova, Università di Bologna, Università di Pavia, Università di Pisa, Politecnico di Milano, University of Hannover, A. Volta high school in Reggio Calabria, Provincia di Bolzano, Provincia di Como, Regione Valle d'Aosta, ARPA Veneto, ARPA Toscana, City of Paris, Bruitparif, at least 10 cities participating to Eurocities meeting).
11.1	No. of unique visits	0	70000	170000	Number	Current value: 8174
11.2	Number of articles in print media (e.g. newspaper and magazine articles)	0	400	400	number	Current value: 33

LIFE E-VIA KPI updating

Indicator code	First level descriptor	Start value	End value	Beyond End value	Unit	Notes
11.2	Number of different displayed information created (posters, information boards)	0	30	30	number	Current value: 31 on 30 noticeboards produced including 1 roll up Expected value: 34
11.2	Other distinct media products created (e.g. different videos/broadcast/leaflets)	0	3	3	number	Current value: 7 on 3: 2 videos+2 leaflets+3 press conferences
11.2	Number of events/exhibitions organised	0	4	4	number	Current value: 4 on 4: Webinar on the LIFE E-VIA projects and other contributions + stand at Expomove 2021, final event + stand at Expomove 2022
11.2	Publications/reports	0	40	40	number	32 on 40: 22 papers + 10 reports Expected: 3 additional papers + 10 reports
11.2	Number of Hotline/information centers created	0	1	1	number	Current value: 1 (website contact form)

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 5TH December 2022 - Firenze

Vienrose Ingegneria
Responsible for actions B5, D1 and D2

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

COMUNE DI FIRENZE

Ⓒntinental
The Future in Motion

Université Gustave Eiffel

TECHNOLOGY COMPANY iPOOL MATERIAL DESIGN

Università degli Studi Mediterranea di Reggio Calabria

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Action A1 - EVs and their noise emission

o Preparatory action

o 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)

o Contributing partners: UNI EIFFEL, VIENROSE, UNIRC

o Deliverable validated on 12/06/2020, , available on the
  website: https://life-evia.eu

LIFE E-VIA

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

LIFE18 ENV/IT/000201

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 A1 - EVs and their noise emission

Expected results (from proposal)	Achieved results	Deliverable
1. Electric vehicle fleet and distribution.	Done - Electric vehicle fleet and distribution	A1 – sec. 2
2. Changes of driving behaviour.	Done - Changes of driving behaviour impacting noise emission	A1 – sec. 3
3. Changes in noise source emission.	Done - Noise source emission of electric vehicles	A1 – sec. 4
4. Changes in noise perception.	Done - Changes in noise perception	A1 – sec. 5
5. EV consideration in noise prediction models.	Done - EVs in noise prediction models	A1 – sec. 6

Action B2 – Tyre-pavement coupling study

o Implementation action of the LIFE E-VIA project

o Tyre-pavement coupling study divided in 4 sub-actions:

- B21: Acoustical characterization of EVs on existing tracks

- B22: Construction of a B1-based test track prototype

- B23: Characterization of the B1-based prototypal test section

- B24: Selection of optimized EV tyres

o Contributing partners: UNI EIFFEL, UNIRC, IPOOL, CRD

o Final deliverable published on 13/05/2022, available on the website: https://life-evia.eu

LIFE E-VIA

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

LIFE18 ENV/IT/000201

Deliverable	Report on action B2
Content	Prototype implementation and tyre/road noise performances
Action/Sub-action	B2: Tyre-pavement coupling study and prototype implementation
Status - date	Final version - 13-05-2022
Authors	Julien CESBRON, Marie-Agnès PALLAS, Simon BIANCHETTI, Philippe KLEIN and Véronique CEREZO (UNI EIFFEL)
	Antonino MORO and Francesco BIANCO (IPOOL)
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Action B2 – Tyre-pavement coupling study

o B21: Acoustical characterization of EVs on existing tracks (UNI EIFFEL)

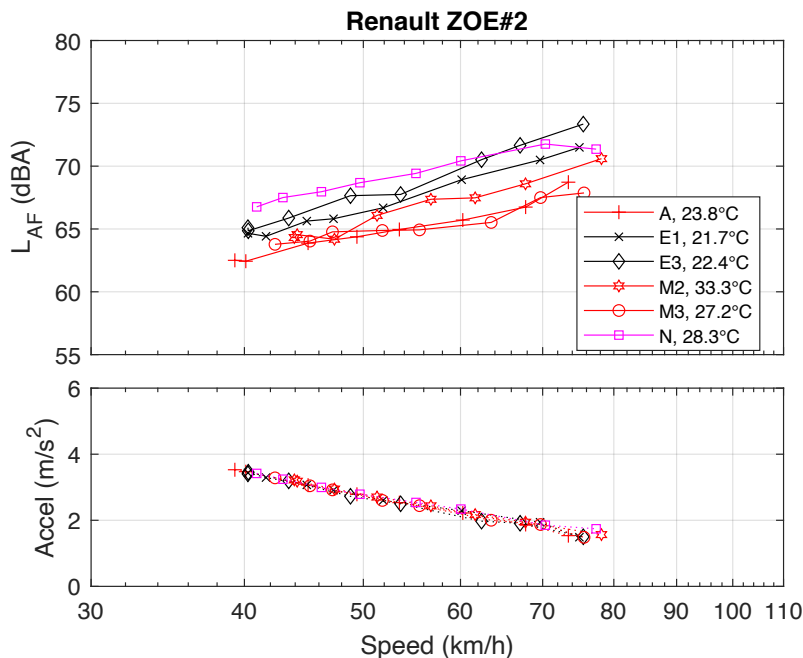| Expected results (from proposal)	Achieved results	Deliverable
Tests on different existing road surfaces of IFSTTAR reference test track in Nantes, e.g. PA 0/6, VTAC 0/6 or 0/4, DAC 0/10, SMA 0/8 and ISO 10844 road surface	Measurement campaign performed on UNI EIFFEL reference test track on 6 existing road surfaces: • A – PA 0/6, M2 – VTAC 0/6 and M3 – VAC 0/4 • E1 – DAC 0/10, E3 – SMA 0/10 and N - ISO 10844	B2 – sec. 2.1.1
The EV fleet will be at least composed of 3 different EVs available at IFSTTAR. Some additional EVs could be rented by IFSTTAR to complement the fleet. Additional reference ICEVs will also be included in the measurement campaign.	• 3 EVs from UNI EIFFEL fleet (2 Renault ZOE, 1 Renault Kangoo ZE) • 4 rented or lent EVs (Peugeot e-208, BMW i3, Nissan LEAF, Tesla Model 3) • 1 ICEV from UNI EIFFEL fleet (Renault Kangoo diesel)	B2 – sec. 2.1.2
Tests will include source characterization by means of a microphone array located on the roadside and standard Controlled Pass-By (CPB) noise measurements	• Standard Controlled Pass-By (CPB) on all road surfaces (E1, E3, N, A, M2, M3) • Microphone array pass-by measurements on N road surface (ISO 10844)	B2 – sec 2.1.3 (tests description) B2 – sec 2.2 (CPB results) B2 – sec 2.3 (microphone array results)
Tests will enable to investigate EV noise sources in real driving conditions (cruise driving, accelerating and braking conditions)	• Constant speed : from 20 to 110 km/h in 5 km/h steps • Full acceleration for start speeds from 0 to 50/90 km/h initial speed • Regenerative deceleration from 40 to 90 km/h initial speed	B2 – sec 2.1.3 (tests description) B2 – sec 2.2 (CPB results) B2 – sec 2.3 (microphone array results)

o CPB noise levels at **constant speed 50 km/h** (regressed, corrected at 20°C):

- Similar classification of road surfaces for different EV models
- Road surfaces with low macro-texture (M3, N) and/or absorption (A, M2, M3) are the quietest
- Noise level difference between **4.8 dBA and 7.9 dBA**, depending on EV model

Action B21 - Acoustical characterization of EVs
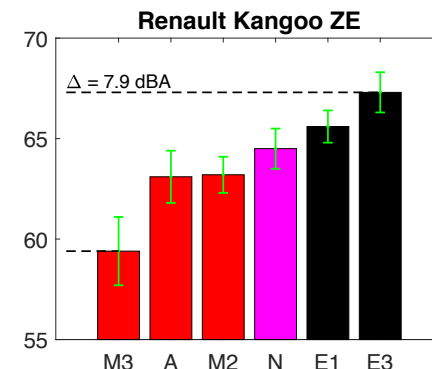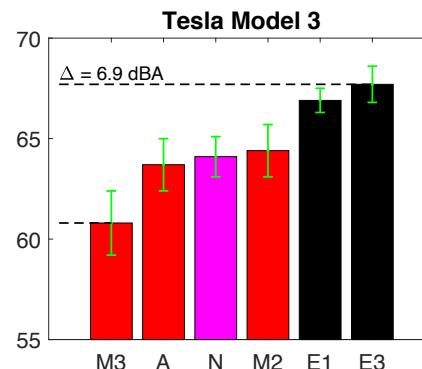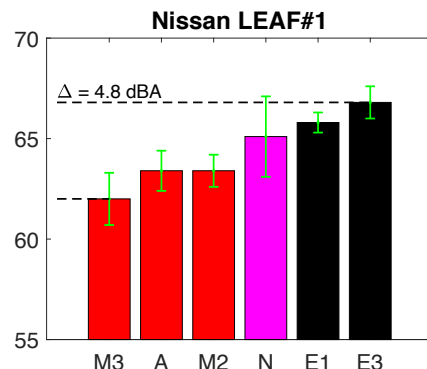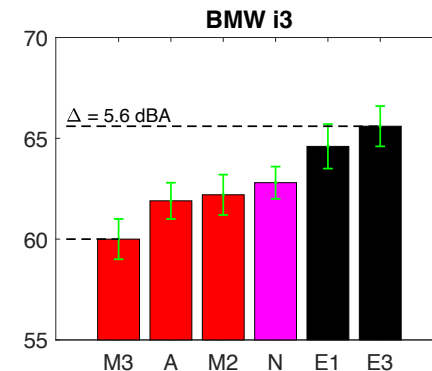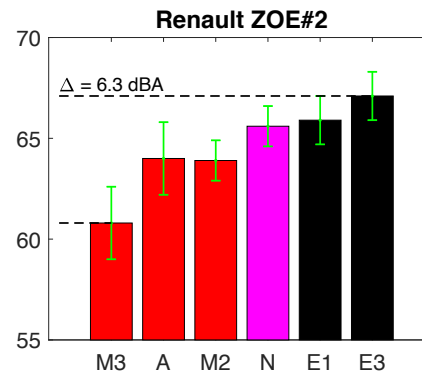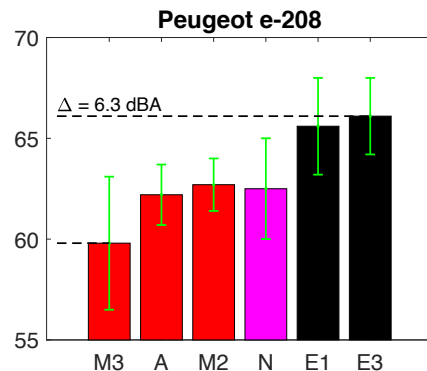
o CPB and microphone array noise levels in **full acceleration** conditions:

- Classification of test section similar to passages at constant speed except for N (impervious surface with low macro-texture) becoming among the noisiest, especially at low speeds
- Noise increase for N in the order 5 dBA in acceleration compared to constant speed
- Combination of electric motor noise and torque effect increasing rolling noise

CPB noise level
L_{AF} in front of the microphone

Microphone array noise levels at 50 km/h
(Renault ZOE, front wheel driven)
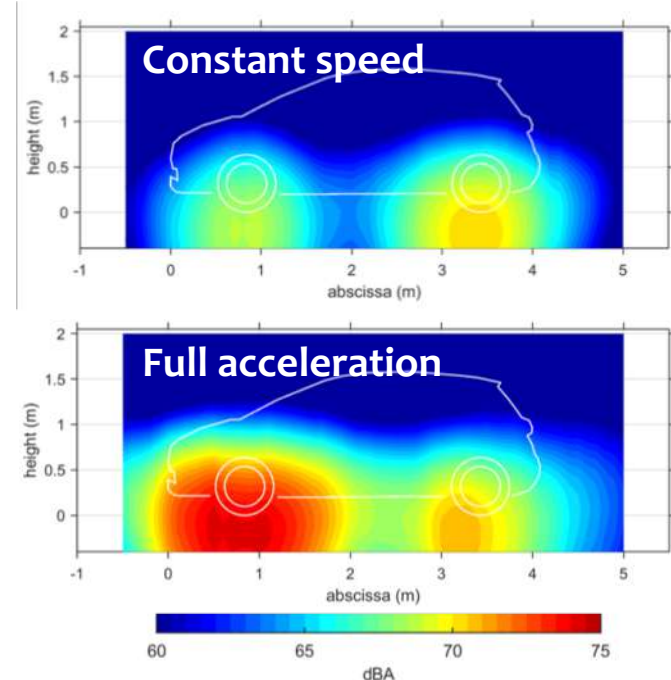
Action B2 – Tyre-pavement coupling study

o B22: Construction of a B1-based test track prototype (UNI EIFFEL, UNIRC)
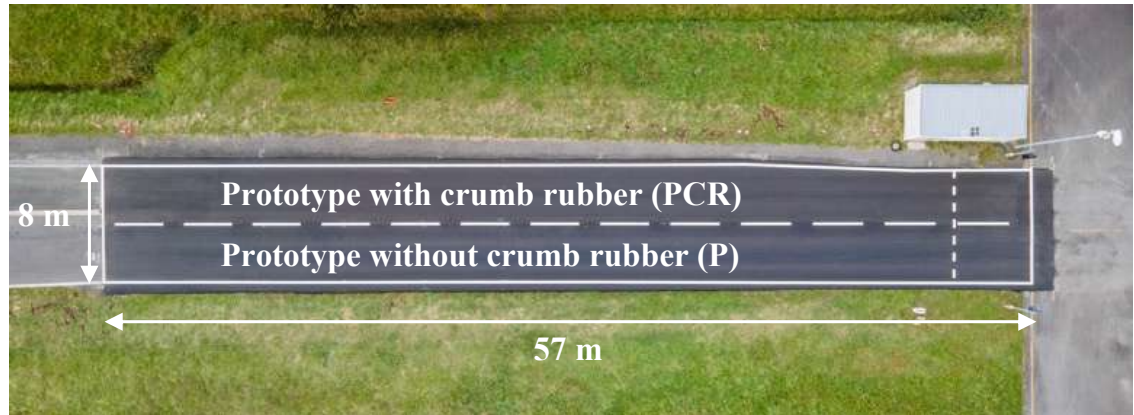
Expected results (from proposal)	Achieved results	Deliverable
A 50m-long by 8m-large prototypal test section will be constructed in July 2020 on IFSTTAR reference test track based on the recommendations of action B1.	• Prototype construction in September 2020, 57m-long by 8m-large • Test site: UNI EIFFEL reference test track in Nantes • Two different mixes of VTAC 0/6 have been laid: test section PCR with crumb rubber and test section P without crumb rubber	B2 – sec. 3.2
The specification of the mix will be given by UNIRC.	• Design of a low-noise asphalt concrete mix for electric vehicles by UNIRC within action B1, following a holistic optimization	B2 – sec. 3.1.1
A call for tender will be launched by IFSTTAR at the very beginning of year 2020 in order to subcontract the building of the prototype to a local road company.	• Call for tender published by UNI EIFFEL in June 2020 • 4 road construction companies consulted by UNI EIFFEL: Charier, Eiffage, Eurovia and Colas • Only Colas company applied for building the prototype and was selected by UNI EIFFEL	B2 – sec. 3.1.2

Action B22 – Prototype construction

o Prototype construction in September 2020

o Test site: Université Gustave Eiffel reference test track in Nantes (France)

8 m

Prototype with crumb rubber (PCR)

Prototype without crumb rubber (P)

57 m

PCR   P   E1 (ref DAC 0/10)

Action B2 – Tyre-pavement coupling study

○ B23: Characterization of the B1-based prototypal test section (UNI EIFFEL, IPOOL)

| Expected results (from proposal)	Achieved results	Deliverable
Road surface texture by means of a 3D-laser sensor, sound absorption by using the impedance tube method (ISO10534-2) and the extended surface method (ISO13472-1) and mechanical impedance.	• 3D surface texture measured on P and PCR • Sound absorption on P and PCR by the extended surface method – ISO13472-1 • Mechanical impedance performed on P and PCR • Drilled core samples sent to UNIRC for testing sound absorption by the impedance tube method	B2 – sec. 4.1.1, 4.1.2 and 4.1.3
CPB and microphone array measurements on the B1-based prototypal test section for a selection of EVs.	• 3 EVs (Renault ZOE, Renault Kangoo ZE and Nissan LEAF) tested on P and PCR • Constant speed, acceleration and deceleration	B2 – sec. 4.2
Simultaneous Close-ProXimity (CPX) and Coast-By (CB) measurements with a Renault Megane Scénic	• Done on P and PCR test sections	B2 – sec. 4.3
Acoustical homogeneity of the test section assessed by means of CPX measurements at different reference speeds. Comparison with several types of road surfaces.	• CPX performed on P and PCR test sections and compared with A, E1, E3, M2, M3 and N test sections	B2 – sec. 4.4.1
Acoustical CPX tests performed by IPOOL with a SRTT tyre (ISO11819-2/3)	• Done by IPOOL on E1 (ref), P and PCR test sections	B2 – sec. 4.4.2
Regarding skid resistance: SRT pendula friction tests, MPD measurements, dynamical wet friction by means of T2GO device and Wehner and Schulze tests in laboratory	• All mentioned tests have been performed	B2 – sec. 4.1.4

Action B23 – Prototype characterization

o Controlled Pass-By (CPB) noise measurements of EVs at constant speed

Renault ZOE
(Michelin Energy EV 185/65 R15)
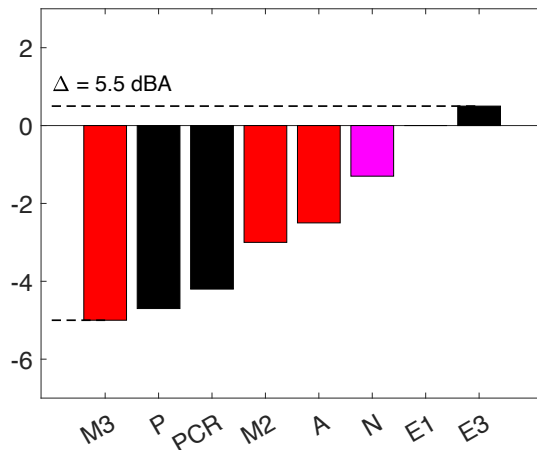
Renault KANGOO Z.E.
(Michelin Energy Saver 195/65 R15)
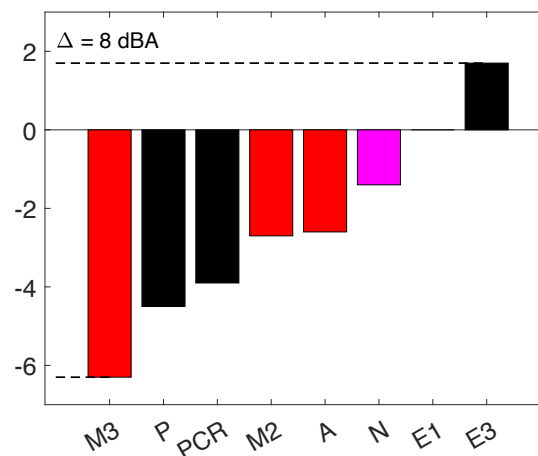
**CPB overall noise levels in dBA
at constant speed 50 km/h
(corrected at 20°C)**

Test section	E1	P	PCR
ZOE	67.3	62.6	63.1
KZE	65.7	61.2	61.8

≈ -4 dB(A)

≈ -4.5 dB(A)

**Prototype test sections P and PCR
are 3.9 dBA to 4.7 dBA quieter
than the reference DAC 0/10 E1**

umr
ae

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

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

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

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

| Test section	E1	P	PCR
Michelin Energy Saver 195/60 R15	86.7 dBA	83.6 dBA	84.0 dBA
SRTT P225/60 R16	90.2 dBA	88.5 dBA	87.8 dBA

P and PCR meet the Core criterion of GPP for a low-noise pavement (L_{CPX} < 90 dBA with SRTT tyres)
PCR close to the more stringent Comprehensive criterion of GPP (L_{CPX} < 87 dBA with SRTT tyres)

Action B2 – Tyre-pavement coupling study

o **B24: Selection of optimized EV tyres (CRD, UNI EIFFEL)**

| Expected results (from proposal)	Achieved results	Deliverable
CRD will deliver carved prototype tyres to IFSTTAR for testing on the prototypal test surface. The tyres will be of a size which is representative for the European EV market. The delivered tyres will include a set of reference tyres. The other tyres will for example be tread pattern, construction and/or compound variations of the reference.	Technical demonstrators of tyres of dimensions 205/55 R16 delivered by CRD to UNI EIFFEL: • 1 set of reference tyres V1 • 5 other tyre sets V2 to V6 (variations of tread pattern)	B2 – sec. 5
Constant speed and accelerated pass-by noise measurements according to UNECE R51.03 and CPX measurements on the prototypal test section and further standard road surfaces.	2 pass-by conditions according to UNECE R51.03 for tyre versions V1 to V6: • Constant speed 50 km/h • Full acceleration with 50 km/h when facing the microphone CPX tests at constant speed performed by UNI EIFFEL in Nantes for tyre version V1 to V4 on P and PCR test sections and compared with A, E1, E3, M2, M3 and N test sections	B2 – sec. 5.1 B2 – sec. 5.2
Pass-by measurements will be performed using EV and ICE test vehicles which will be chosen based on the outcome of action A3, i.e. both the EV and the ICEV should be representative for the respective markets.	The tests involve two vehicles fitted with the same tyres: • an EV Nissan LEAF • an ICEV Renault KADJAR	B2 – sec. 5.1
The optimized tyres will also be tested on the test section in Florence within B4 with the CPX system of IFSTTAR or IPOOL.	Tyre versions V1 to V4 have been tested by IPOOL in Florence on test sections P and PCR of the pilot area (CPB tests with Nissan LEAF)	B4

○ Results for the Nissan LEAF – overall noise levels at 50 km/h
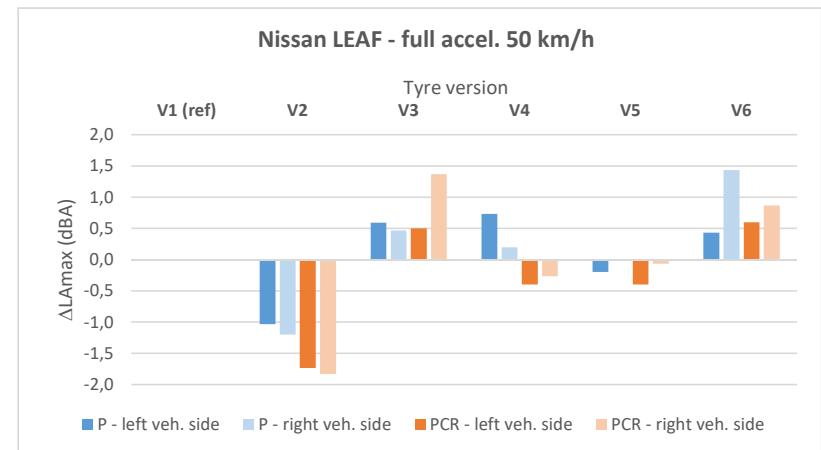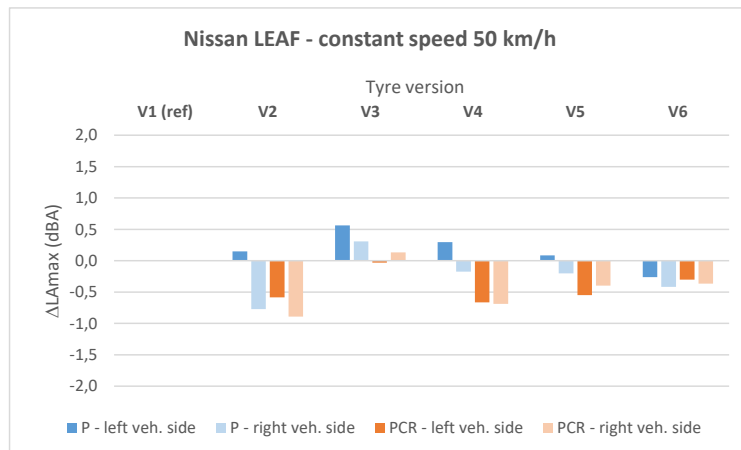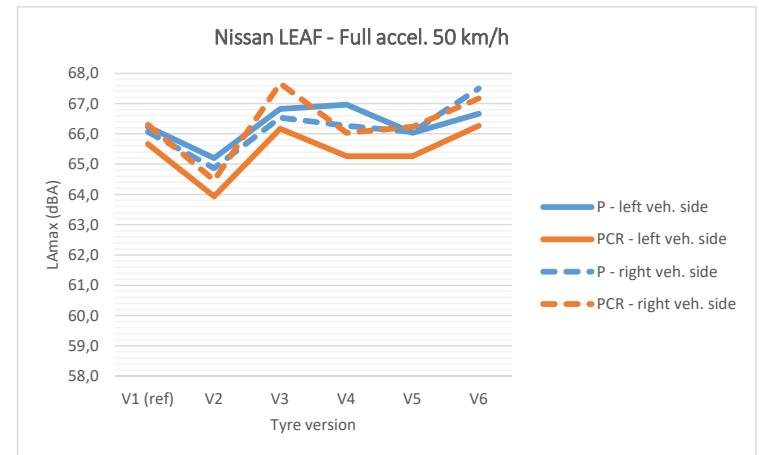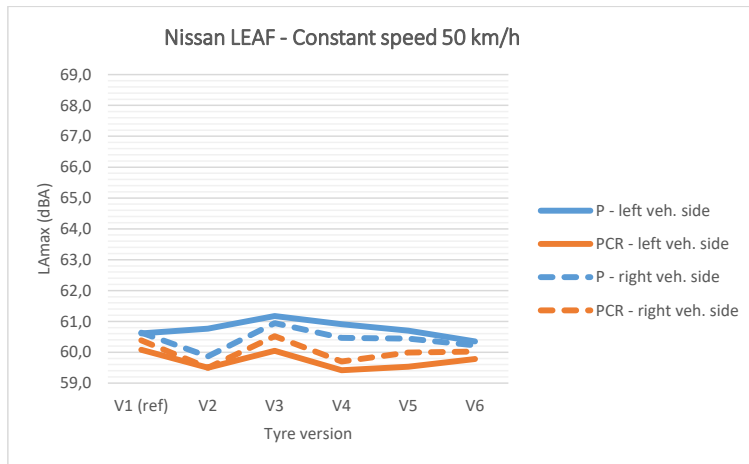
o Overall CPX noise levels measured at constant speed 50 km/h

- P and PCR among the quietest road surfaces : noise reduction between 4.2 and 5.8 dBA
- PCR up to 1.1 dBA quieter than P (depending on tyre version)
- Noise reduction relative to tyre V1: up to -0.6 dBA on PCR for V2 and -1 dBA on P for V4

V1			
Surface	V	L_{rAeq}	ΔL_{rAeq}
M3	50.3±0.5	80.1±0.3	-7.7
PCR	50.0±0.8	82.4±0.4	-5.4
P	50.7±0.8	83.1±0.4	-4.7
A	50.5±0.5	84.5±0.9	-3.3
N	50.3±0.5	85.7±0.6	-2.1
M2	50.6±0.4	86.2±0.9	-1.6
E1	50.6±0.6	87.8±0.7	NA
E3	50.4±0.7	88.3±0.5	+0.5

V2			
Surface	V	L_{rAeq}	ΔL_{rAeq}
M3	50.4±0.5	79.8±0.5	-7.7
PCR	50.2±0.3	81.8±0.8	-5.6
P	50.7±0.3	82.8±0.5	-4.6
A	50.4±0.8	84.5±1.0	-2.9
N	50.7±0.6	85.3±0.6	-2.1
M2	50.0±0.5	85.9±0.7	-1.5
E1	50.1±0.5	87.4±0.7	NA
E3	50.1±0.4	87.9±0.4	+0.5

V3			
Surface	V	L_{rAeq}	ΔL_{rAeq}
M3	50.3±0.4	80.1±0.5	-7.4
PCR	50.3±0.3	82.2±0.5	-5.3
P	51.3±0.7	83.3±0.4	-4.2
A	50.3±0.8	84.3±1.0	-3.2
N	50.5±0.7	85.4±0.6	-2.1
M2	50.6±0.6	86.2±0.8	-1.3
E1	50.0±0.6	87.5±0.7	NA
E3	49.7±0.5	87.9±0.5	+0.4

V4			
Surface	V	L_{rAeq}	ΔL_{rAeq}
M3	50.0±0.7	79.2±0.4	-8.6
PCR	50.3±0.8	82.0±0.9	-5.8
P	50.2±1.3	82.1±0.6	-5.7
A	50.4±0.4	84.2±1.0	-3.6
N	50.1±0.5	85.1±0.6	-2.7
M2	50.8±0.7	86.0±0.9	-1.8
E1	50.7±0.6	87.8±0.7	NA
E3	50.2±0.9	88.1±0.6	+0.3
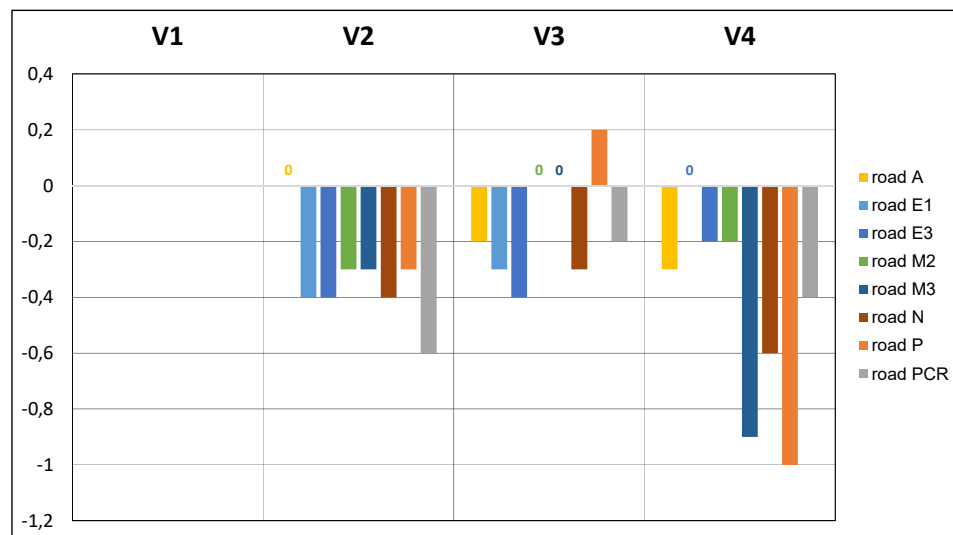
Thank you for your attention

o Contact:

- julien.cesbron@univ-eiffel.fr
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o 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