



Journées Techniques
Acoustique et Vibrations
Lille – France – 11-12 mars 2020



LIFE E-VIA : contrôle du bruit des véhicules électriques par optimisation de l'interaction pneumatique-chaussée

Julien CESBRON, Marie-Agnès PALLAS, Philippe KLEIN,
Simon BIANCHETTI, Adrien LE BELLEC, Vincent GARY

Université Gustave Eiffel – UMRAE





- LIFE **E-VIA** : Electric Vehicle noise control by **A**ssessment and optimisation of tyre/road interaction
- European LIFE 2018 program – Environment and Resource efficiency
- Project reference: LIFE18 ENV/IT/000201
- Duration: 01/07/2019 to 31/01/2023
- Total budget: 1 797 030 €
- EU contribution (55%): 933 295 €
- Project location: Italy, France, Germany
- Website: <https://life-evia.eu>



○ Italy:

- Municipality of Florence (FI, Coordinator – Contact person: Arnaldo Melloni)
- Mediterranea University of Reggio Calabria (UNIRC)
- iPOOL S.r.l (IPOOL, spin-off company of Pisa CNR)
- Vie en.ro.se Ingegneria S.r.l (VIENROSE, consultancy firm – Florence)

○ France:

- Université Gustave Eiffel (IFSTTAR, Nantes, Lyon)

○ Germany:

- Continental Reifen Deutschland GmbH (CRD, tyre manufacturer – Hannover)



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di Reggio Calabria



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Ingegneria





- **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.
- Reduce noise for roads **inside very populated urban areas** through the implementation of a mitigation measure aimed at **optimizing road surfaces and tyres of Electric Vehicles**. Two road surfaces and at least 5 different EV (including tyres specifically designed for EVs) will be tested.
- The soundscape holistic approach will be used to **evaluate the performance** of EV vs ICEV in the newly built scenario.

Action		2019				2020				2021				2022				2023				2024			
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	I	II	III	IV
A. Preparatory actions (if needed)																									
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 (obligatory)																									
B.1	Tracks design				■	■	■	■	■	■															
B.2	Tyre-pavement coupling study and prototype implementation			■	■	■	■	■	■	■	■														
B.3	Pilot area: Implementation. Replication and tranferability						■	■	■	■	■	■	■	■	■	■	■	■	■						
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			■	■	■	■	■	■	■	■	■	■	■	■										
C. Monitoring of the impact of the project actions (obligatory)																									
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 (obligatory)																									
D.1	Information and awareness raising activities			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						
D.2	Technical dissemination activities to stakeholders			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						
E. Project management (obligatory)																									
E.1	Coordination, Monitoring and Project management			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						
E.2	After LIFE Plan																		■	■					



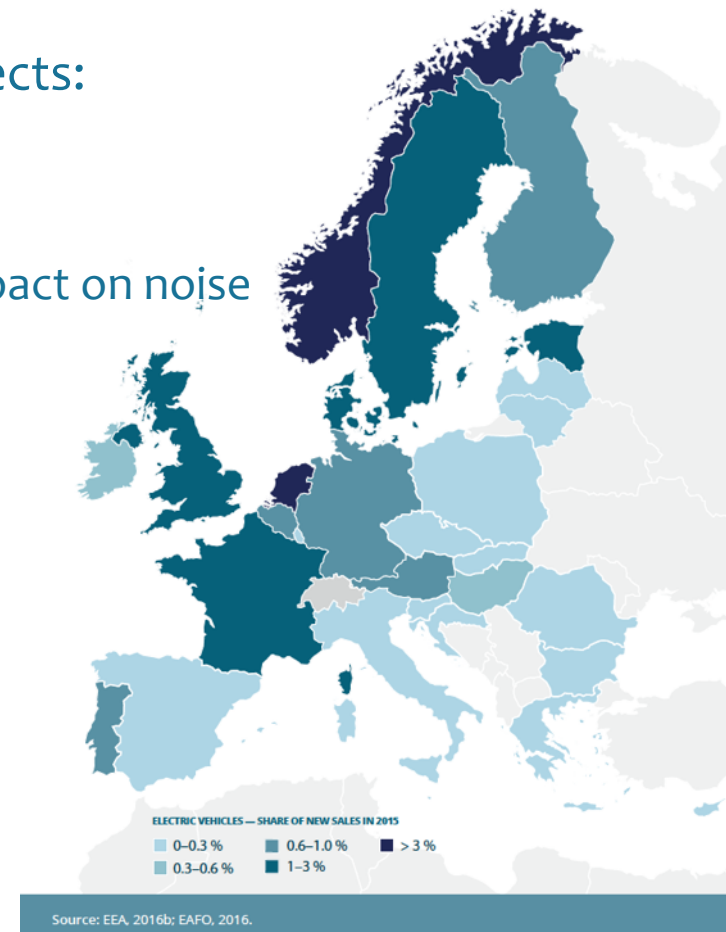
- **Awareness raising:** 20 000 individuals reached. The estimation has been based on the experience on previous LIFE Projects and on the several initiatives that are planned during the project.
- **Noise level reduction:** reduction of L_{den} and L_{night} noise levels by 5dB(A). The estimation of noise exposure at receivers living roadside.
- **Soundscape improvement:** acoustic perception and comfort of an optimized asphalt and EV with respect to a standard one. The estimation of the perception improvement will be verified according to the questionnaires that will be collected.
- **Number of people affected by noise reduction :** the estimation is based on the evaluation of the number of residents in a buffer of 50m from the street axis.

- IFSTTAR is **leader** in actions:
 - A1: Electric vehicles and their noise emission
 - B2: Tyre-pavement coupling study and prototype implementation

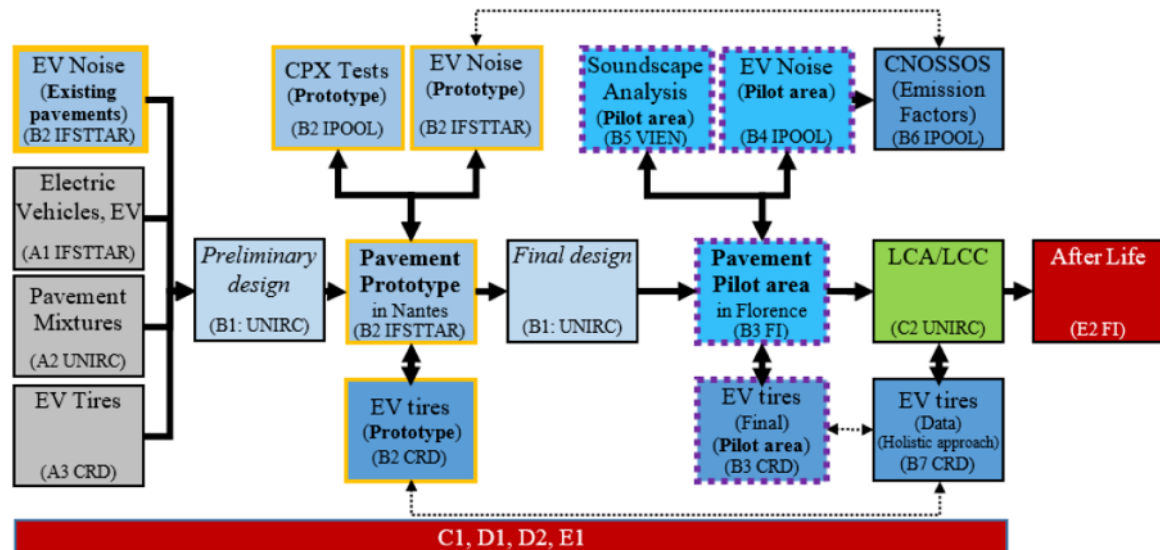
- IFSTTAR **contributes** to:
 - A2, A3: preparatory actions
 - B1, B3, B4, B6, B7, B8: implementation actions
 - C2, D1, D2, E1 : monitoring, dissemination and management

Partners	Actions															
	A1	A2	A3	B1	B2	B3	B4	B5	B6	B7	C1	C2	D1	D2	E1	E2
FI				X		X			X		X		X	X	X	
CRD			X		X	X				X			X	X	X	X
IFSTTAR	X	X	X	X	X	X	X		X	X	X		X	X	X	
IPOOL		X			X				X		X	X		X	X	
UNIRC	X	X		X	X	X					X	X	X	X	X	
VIEN	X					X		X			X		X	X	X	

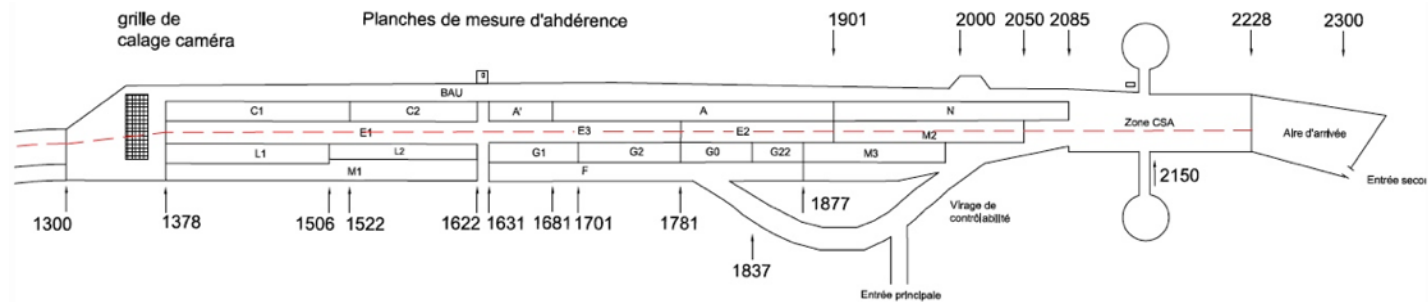
- Preparatory action (Months 1 to 7)
- Literature review considering different aspects:
 - EV fleet and distribution across Europe
(linked with action B3)
 - Changes of driving behaviour with EV and impact on noise
(linked with actions B1 and B2)
 - Changes in noise source emission
(linked with action B2)
 - Changes in noise perception
(linked with action B5)
 - EV consideration in noise prediction models
(linked with action B6)
- Contributing partners: VIENROSE, UNIRC



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



- Measurement campaign performed on IFSTTAR reference test track



N – ISO 10844

E1 – DAC 0/10

E3 – SMA 0/8



A – PA 0/6

M2 - VTAC 0/6

M3 - VTAC 0/4



3 impervious
road surfaces

3 absorbing
road surfaces

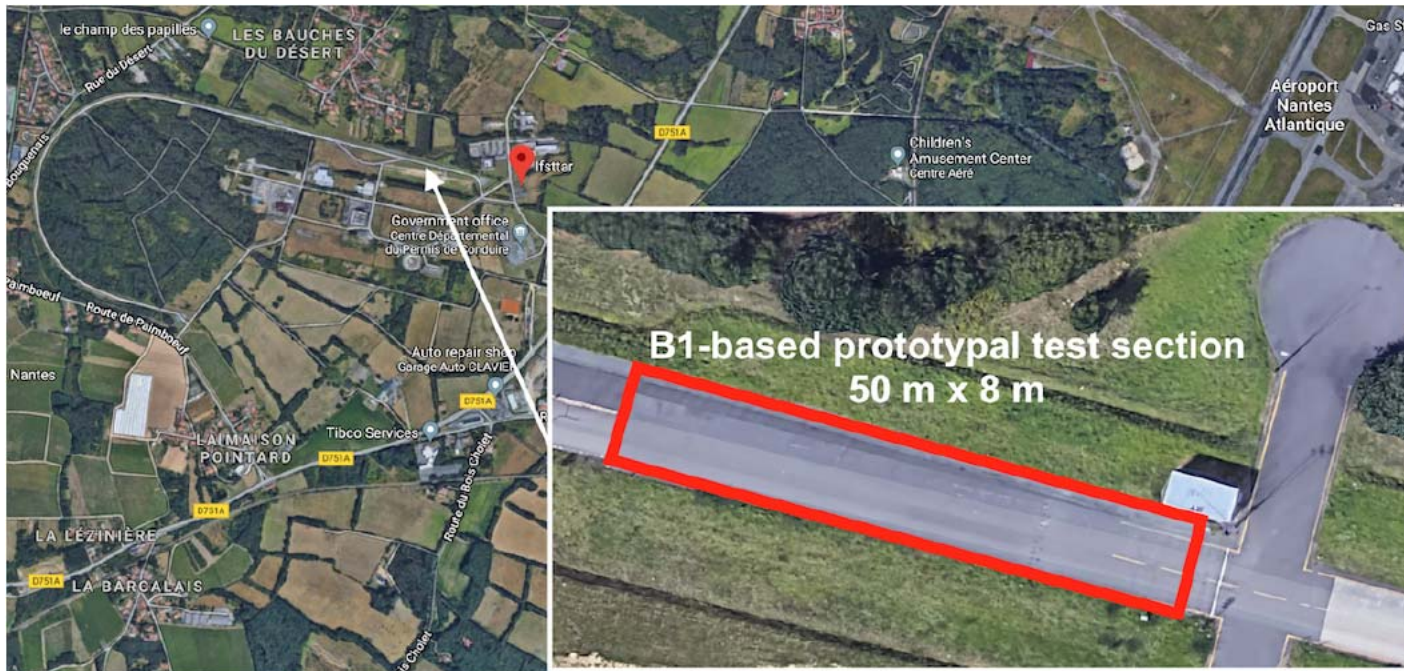
- Types of measurements
 - Standard Controlled Pass-By (CPB) on all road surfaces
 - Microphone array pass-by measurements (only on ISO 10844 road surface)
- Pass-by conditions :
 - Constant speed : from 20 to 110 km/h in 5 km/h steps
 - Full acceleration for start speeds from 0 to 50 km/h, in 10 km/h steps
 - Braking for start speeds from 40 km/h to 70 km/h, in 10 km/h steps



- Planned vehicles:
 - One ICE Vehicle (Renault Kangoo Diesel)
 - Several EVs (Renault Kangoo ZE, Renault Zoe, C-Zero, Nissan Leaf, BMW i3, Tesla Model 3)
- Already tested in August 2019:
 - Renault Kangoos (ICEV and EV) and Renault Zoe



- Construction of a B1-based test track prototype:
 - Located on IFSTTAR reference test track in Nantes
 - Call for tender planned in April 2020 based on B1 recommendations
 - Construction planned in July 2020





- CPB and microphone array measurements on several EVs
- CPX measurements
- Measurement of road surface properties influencing tyre/road noise
 - 3D surface texture
 - Sound absorption (impedance tube and extended surface method)
 - Mechanical impedance
- Other road surface properties:
 - SRT pendula friction tests
 - MPD measurements
 - Dynamical wet friction test
 - Wehner and Schulze tests (assessment of friction durability from surface samples)



- Carved prototype tyres delivered by CRD to IFSTTAR for testing on the prototypal test surface between autumn 2020 and autumn 2021:
 - Reference tyres: standard European summer replacement market at the time of testing (e.g. Continental EcoContact 6)
 - Other tyres: 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
- Tests to be performed by IFSTTAR:
 - Constant speed and accelerated pass-by noise measurements
 - CPX measurements on the prototypal test section and further standard road surfaces
 - Pass-by measurements will be performed using EV and ICE test vehicles representative of the respective markets



○ Contact:

- julien.cesbron@ifsttar.fr
- marie-agnes.pallas@ifsttar.fr

○ Links:

- <http://www.umrae.fr/>
- <https://life-evia.eu>



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