



**Renault
Group**

**A new method for measuring noise pollution in real life
from a passenger car**

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Foreword

THE FOLLOWING CONTENT IS MADE TO INFORM TASK FORCE VEHICLE SOUND ABOUT AN INNOVATION PATENTED BY RENAULT REGARDING AUTOMOTIVE NOISE POLLUTION CONTROL IN THE ENVIRONMENT.

Content:

- **Reminder of the context related to the Noise pollution**
- **External automotive noise emission**
 - Reminder
 - Noise : the most efficient countermeasure is road surface
 - **The car turns into a road sensor**
 - Comparison to current test method
 - **Tests in real life & 1st feedback including impact on other vehicle performances**

Reminder of the context : **Noise Pollution** (European Environment agency, 2020)



25%

Of Europeans are submitted to road traffic noise over WHO limit 55dB Lden

Annoyance



20 000 000

Almost 20 million Europeans are annoyed by environmental noise.

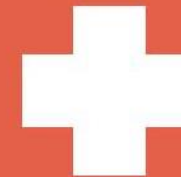
Sleep disturbance



8 000 000

At least 8 million Europeans suffer sleep disturbance due to environmental noise.

Health impacts



43 000

Noise pollution causes 43 000 hospital admissions in Europe per year.

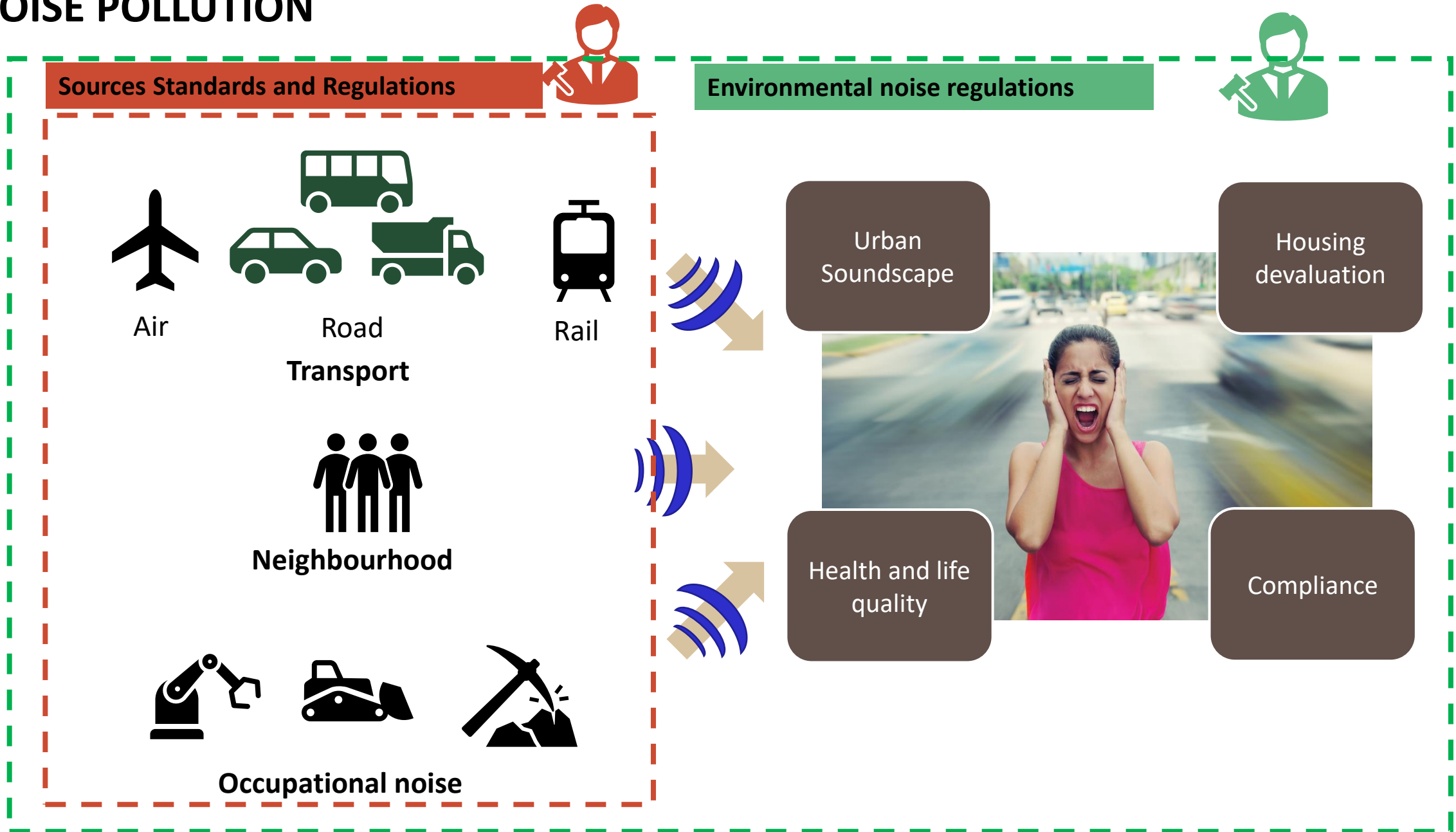
Premature deaths



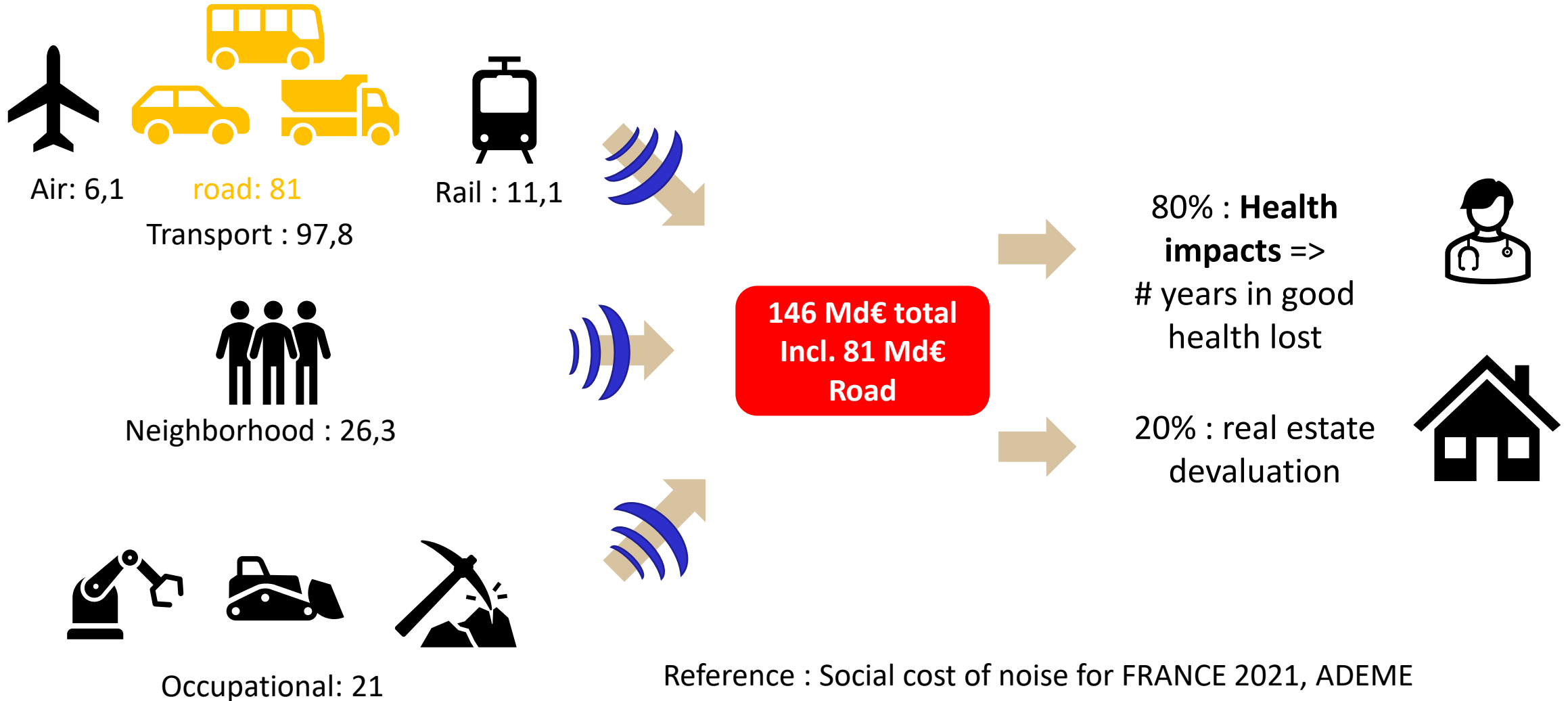
10 000

Noise pollution causes hypertension and cardiovascular disease, leading to an estimated 10 000 premature deaths annually in Europe.

NOISE POLLUTION



SOCIAL COST OF ROAD NOISE = 81 MDSE€/ YEAR (FRANCE 2021)



Reference : Social cost of noise for FRANCE 2021, ADEME
<https://librairie.ademe.fr/cadic/6130/rapport-cout-social-bruit-2021.pdf>



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External automotive noise emission

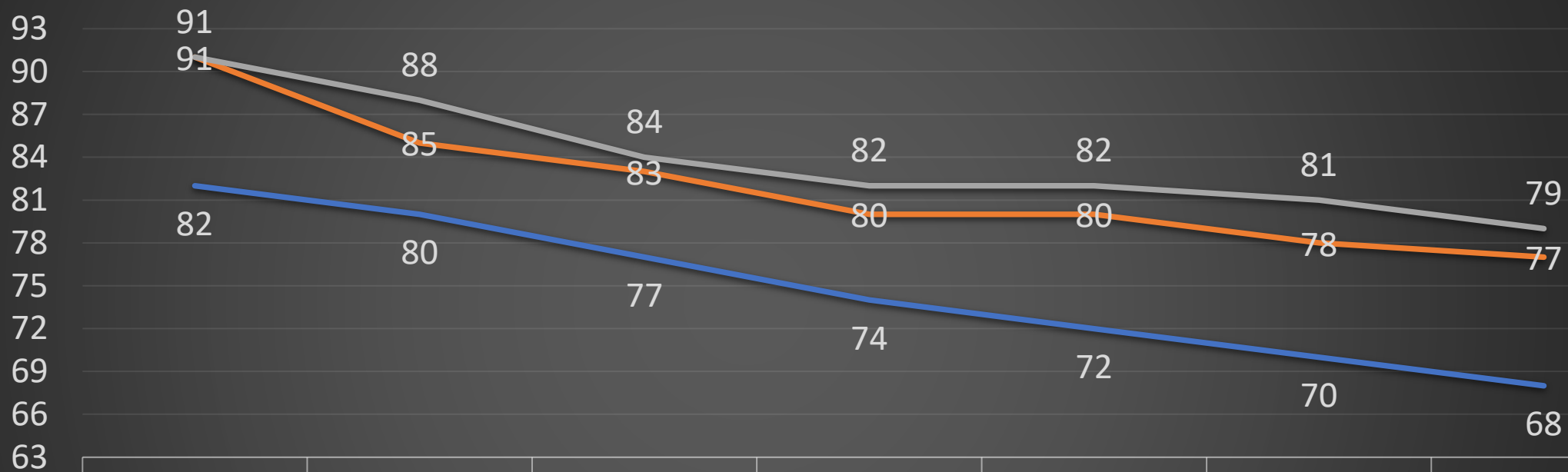
80% OF PASSENGER CARS EXTERNAL NOISE IS TIRE/ROAD INTERACTION (ON REAL ROADS)



100% IN THE CASE OF EVS

Source : Renault, 2020

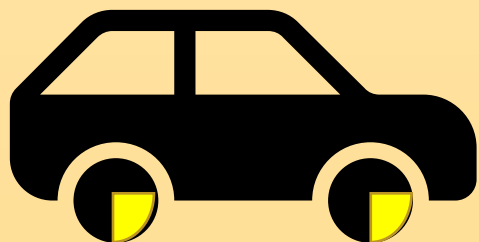
R51 limits over time



	1970	1980	1988	1995	2016	2020	2024
— Car	82	80	77	74	72	70	68
— Bus	91	85	83	80	80	78	77
— Heavy truck	91	88	84	82	82	81	79

TECHNICAL INSIGHT FOR PASS-BY NOISE REGULATION (UN-R51) : TIRE/ROAD INTERACTION CONTRIBUTION (FOR THE FULL PBN TEST)

Up to 2020 :72dB
(Phase 1)

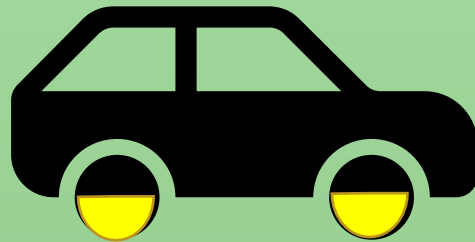


≈25% from
Tire/Road contact



≈90% from
Tire/Road contact

Up to 2024 :70dB
(Phase 2)

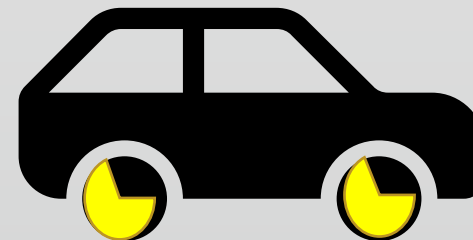


≈50% from
Tire/Road contact

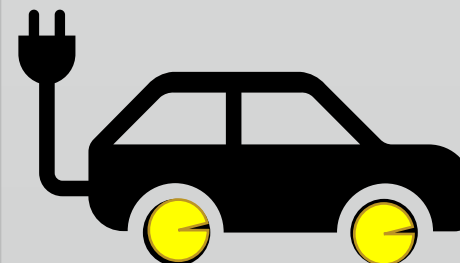


≈90% from
Tire/Road contact

From 2024 :68dB
(Phase 3)



≈70% from
Tire/Road contact

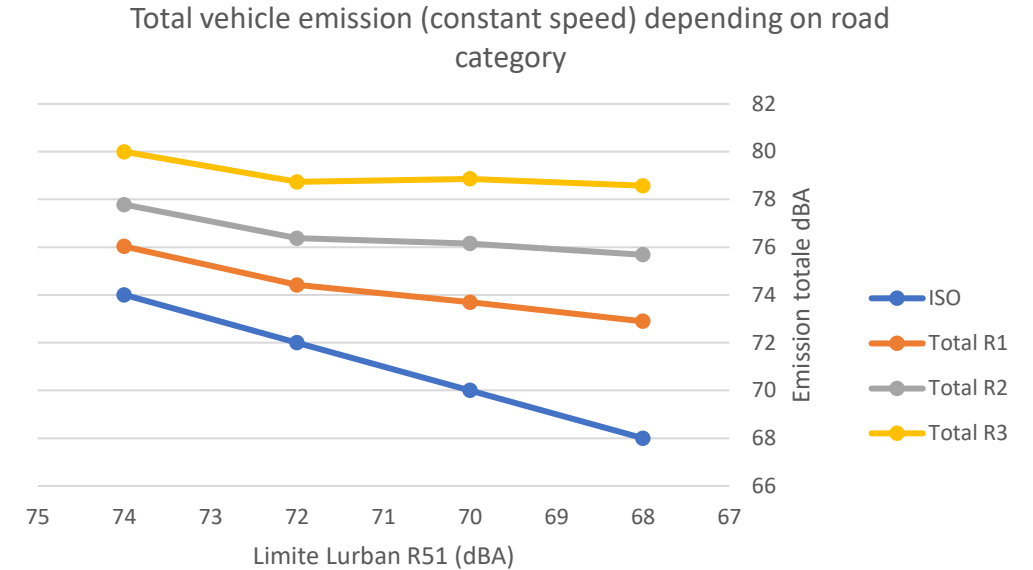
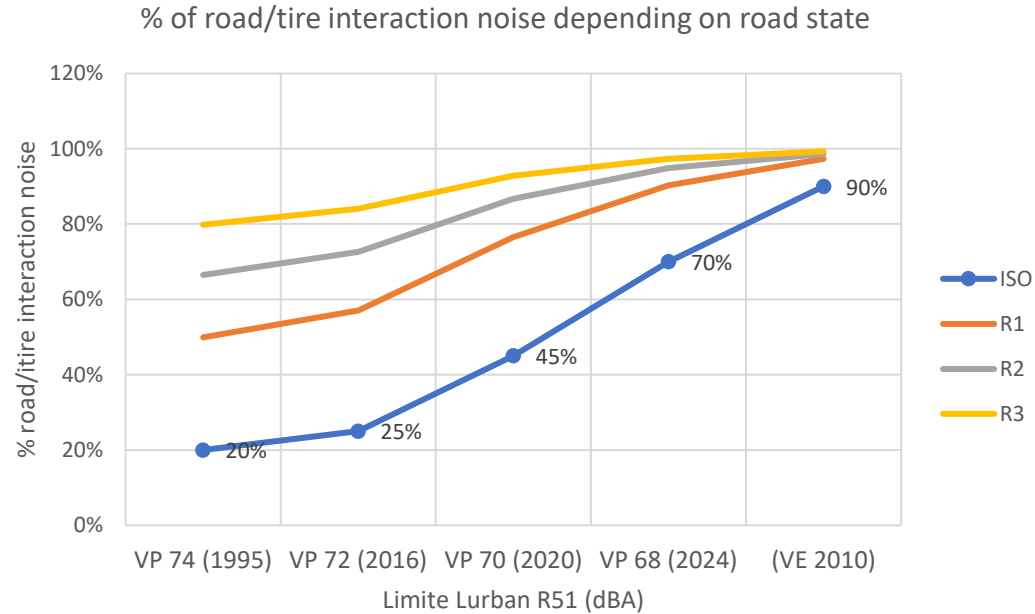


≈90% from
Tire/Road contact

(on **ISO Tracks** in homologation conditions for mean vehicle & mean tire)

Source : Renault, 2020

COMPARISON BETWEEN ISO HOMOLOGATION AND REAL WORLD



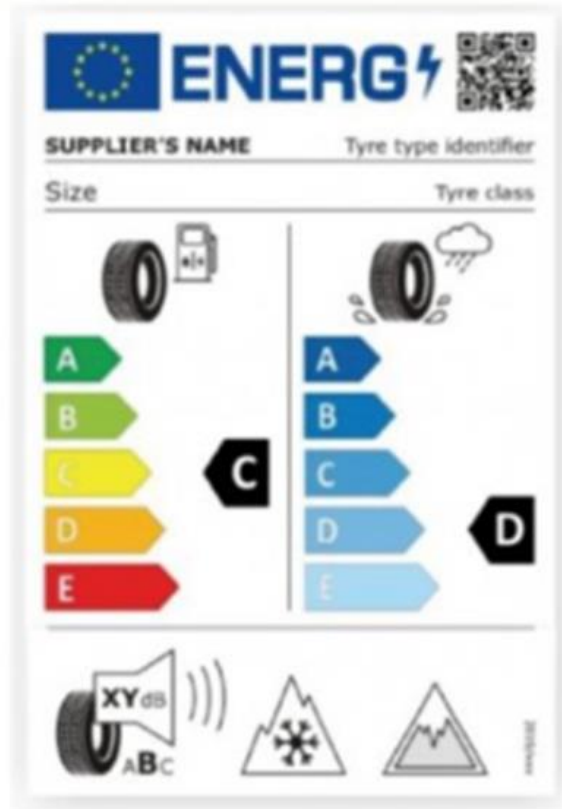
On real roads (R1/2/3), the road/tire interaction is dominant even for old vehicles. This dominance is even greater with rougher roads

As a result, the total emission of vehicles on real roads is coming to an asymptote : 2 dB gained on homologation is at best 1 dB on the best road, and almost no gain on medium or rough roads.

ROAD NOISE : THE MOST EFFICIENT COUNTERMEASURE IS ROAD SURFACE



Pass by noise (UN-R51)



Tire noise (UN-R117)



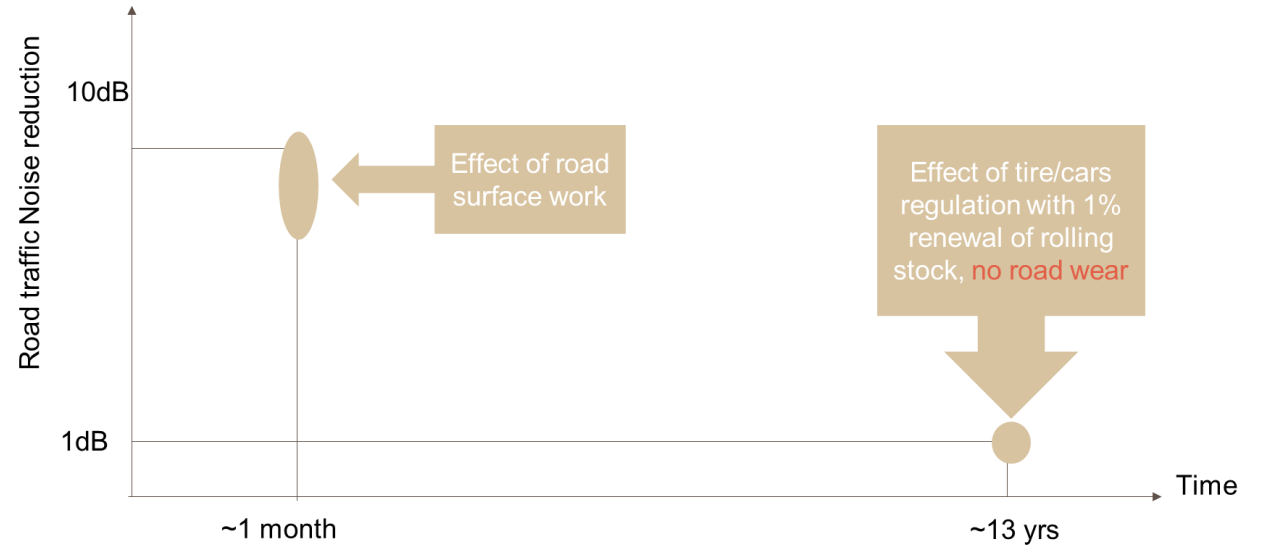
Road surface acoustic performance : usually unknown

-2dBA / 4 years

≈ -10 dBA / 1 month

WHAT CAN WE EXPECT FROM CURRENT REGULATIONS ?

The cost benefit analysis of road surfac works shows about 1:20 ratio : 1 € invested in road surface saves 20€ on the social cost of noise (see *Bruitparif impact studies*)



Where to start ?

Current methods (close proximity measurement : CPx) are expensive, not deployable everywhere (only on major roads) and not in dense urban areas, and come with uncertainties.

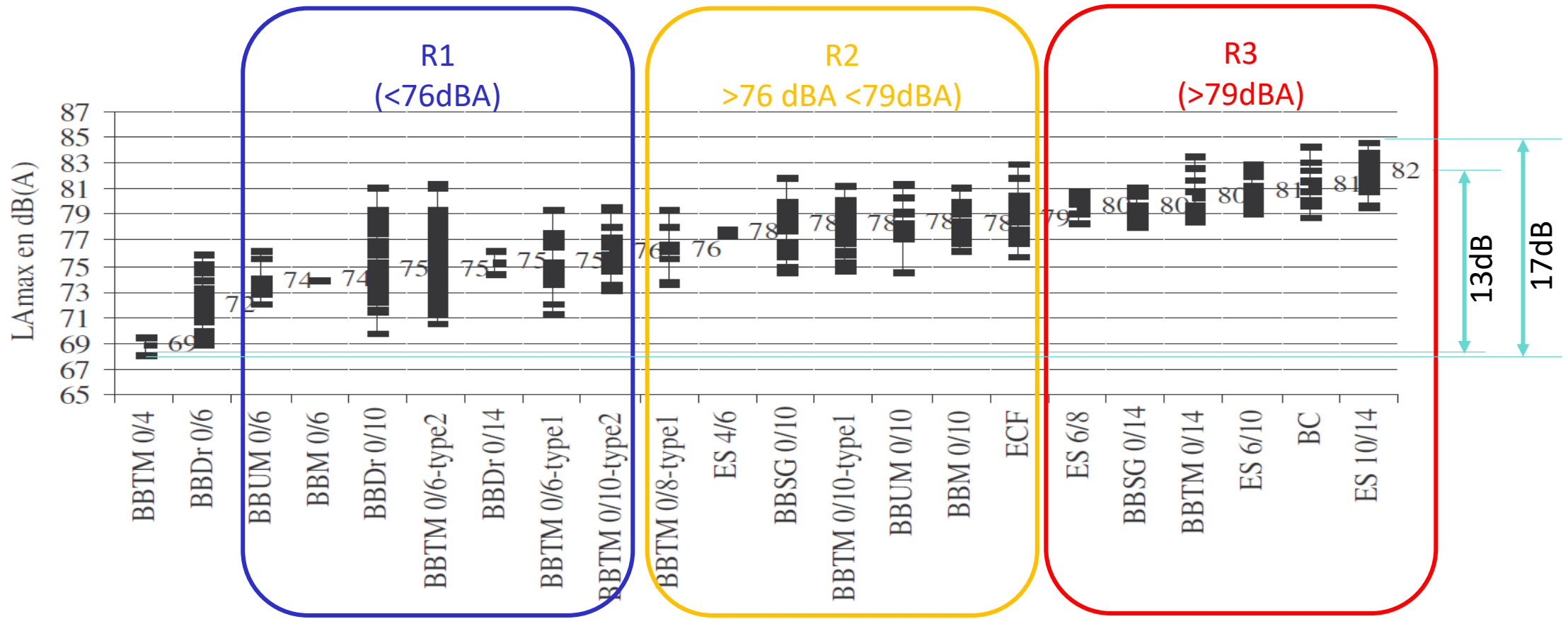
solution

THE CAR TURNS INTO A ROAD SENSOR

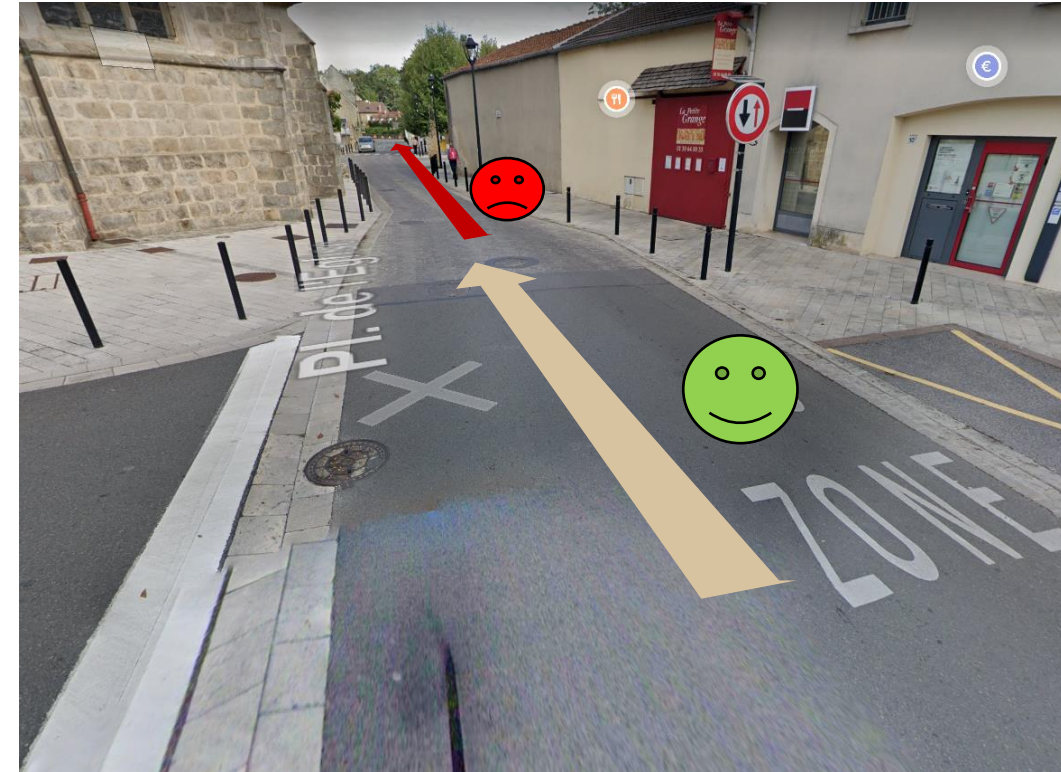


**DEDICATED SCANNING OR LONG-TERM MONITORING:
EVERYWHERE, ALL THE TIME**
PATENTED TECHNOLOGY BY RENAULT

ROAD ACOUSTICS CATEGORIES

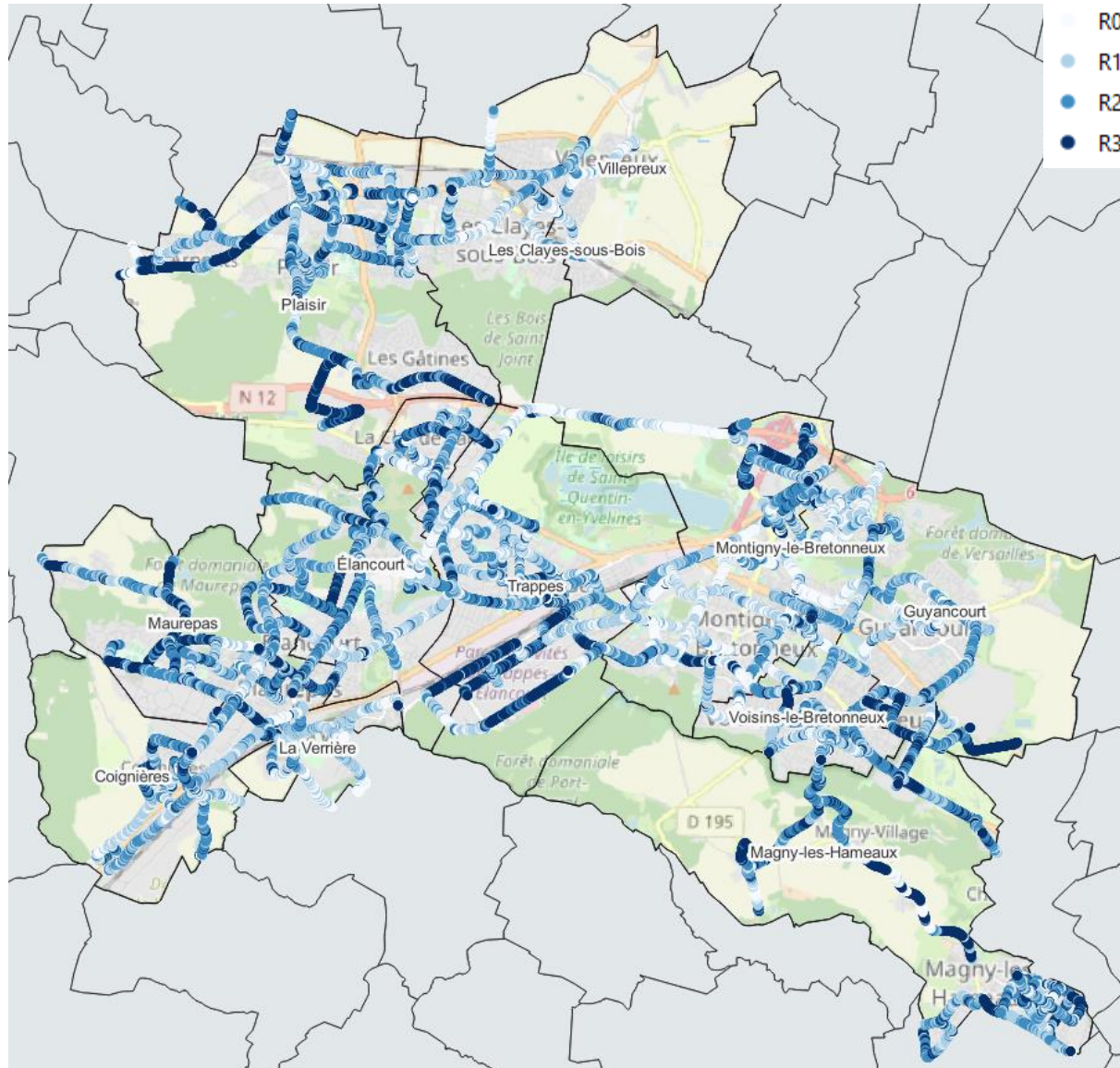


First map of road surface noise assessment (Sept 2022, Renault)

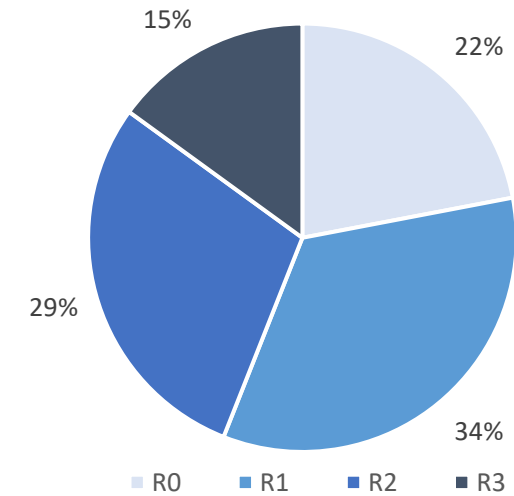


Visual check

400km scanned in Saint Quentin en Yvelines, February 2023, Renault

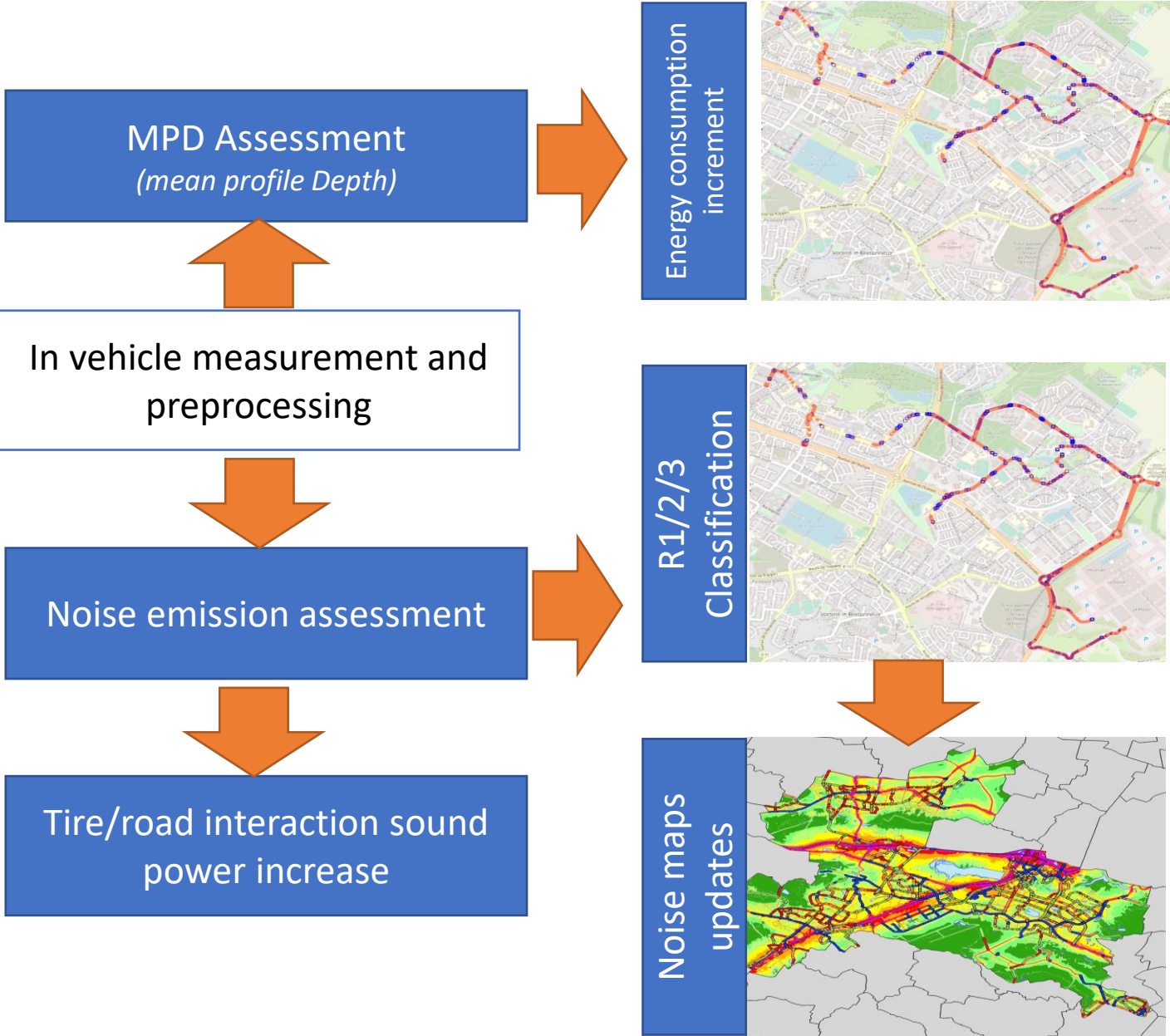
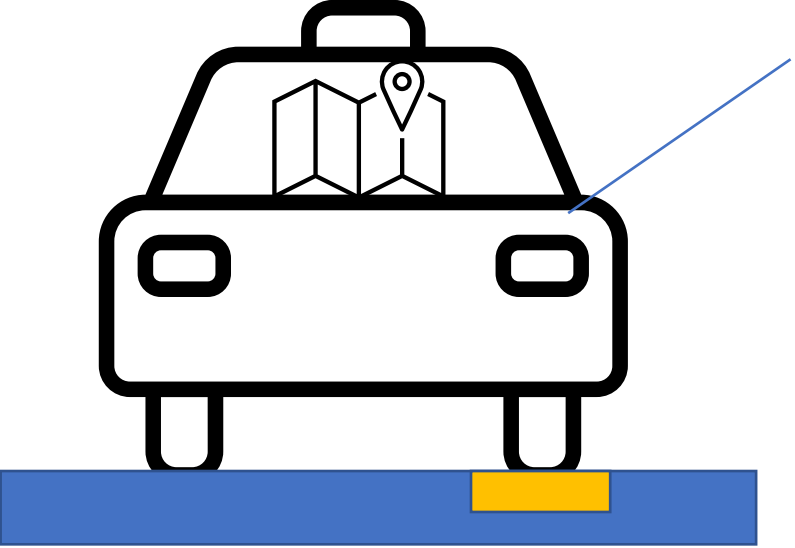


Road acoustic class



- 1 week drive
- Hot spots localization
- Budget framing : how many km of R1/2/3
- Ready to insert into noise maps.

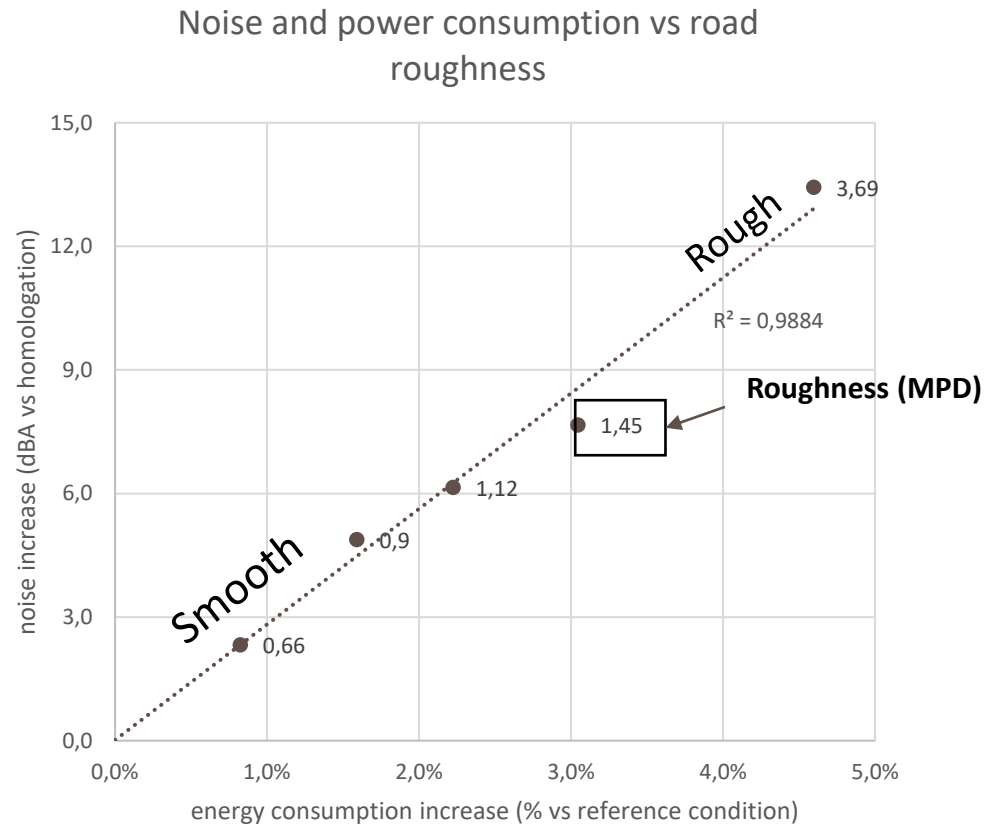
THE NOISE POLLUTION CONTROL SERVICE BY RENAULT



VISION

Future urban soundscape is going to be greatly modified by increased electrification.

The main local environmental impact of an EV is noise



Working for noise pollution control is **the same** as reducing automotive mobility carbon footprint :

- More EVs
- On smoother roads

leads to a reduction of road noise and power consumption :
1% energy reduction is 3 dBA reduction in emitted noise,
(probably covering the carbon footprint of roadworks)

Tire abrasion and particle emission will be reduced too.

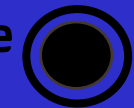
WHICH BUTTON DO YOU THINK WE SHOULD TURN ?

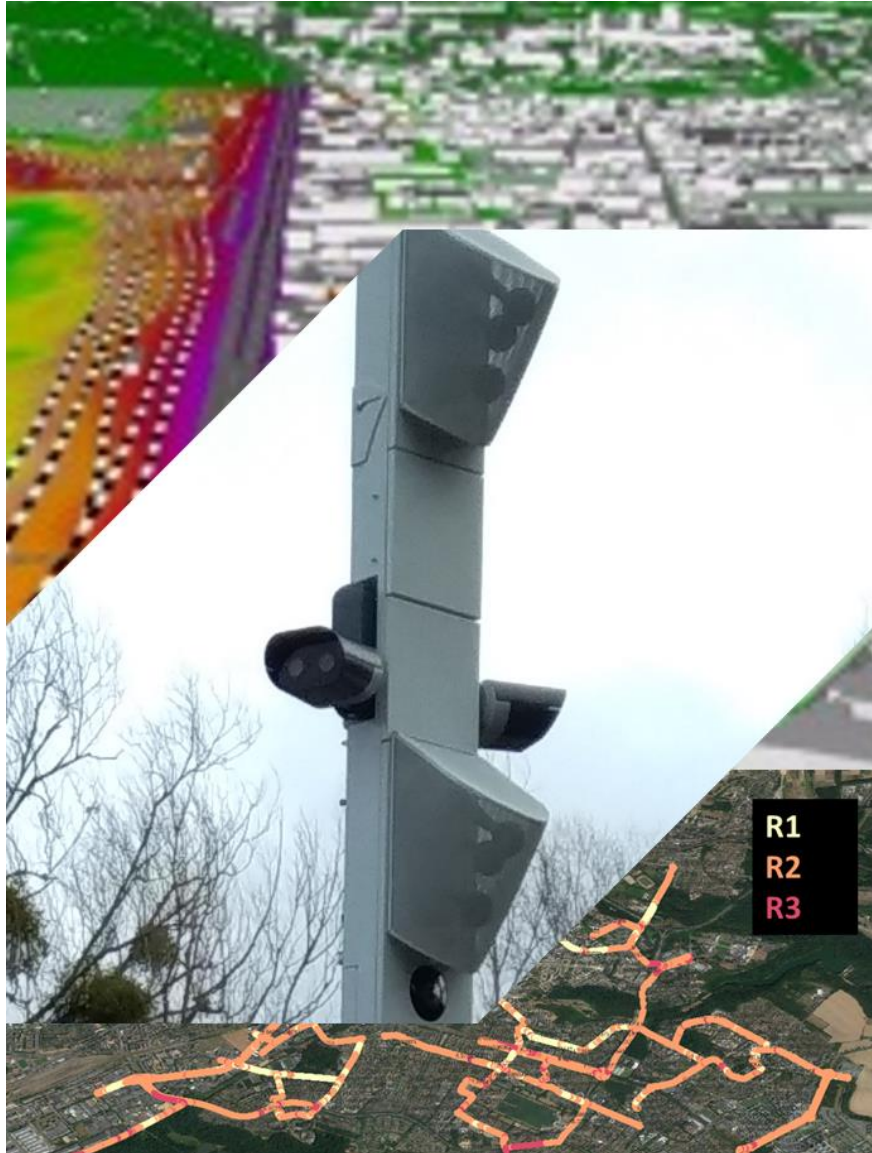
Traffic Flow **Road** **Speed** **Car**

x100 x50 x10 X2,5

2020 1995

Road noise output





A “REAL WORLD” KNOWLEDGE ABOUT ROAD NOISE POLLUTION

- Road network enabling prioritization of roadworks with regards to noise pollution
- Complement to the PPEB (Prevention plans)
- Precise budget for roadworks

NOISE MODELING ENHANCEMENT :

- Bringing the essential missing data for road noise modeling
- Enabling refinement of the social cost of noise and participation of road traffic

AN INNOVATIVE, PRAGMATIC AND EFFICIENT METHOD :

- Major source parameter is addressed
- A complement to coercive measures from noise radars
- An innovation by Renault



Thank you

Cost / benefit analysis from road works



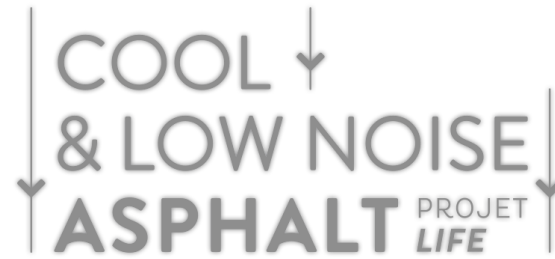
Figure 3 : Cartographie du niveau sonore (selon l'indicateur Lden) généré par l'autoroute A6 en façade des bâtiments de l'Hay-les-Roses **avant** la pose du revêtement antibruit



Figure 4 : Cartographie du bruit routier (selon l'indicateur Lden) généré par l'autoroute A6 en façade des bâtiments de l'Hay-les-Roses **un an après** la pose du revêtement antibruit

DECEMBER 2021 : L'HAY LES ROSES (BRUITPARIF)

- 1,4 km roadworks → 8dB road noise reduction
- CBA : 1/17 : one euro in the roadworks leads to 17€ reduction on the social cost of noise.



PROJECT LIFE “ COOL AND LOW NOISE ASPHALT” : PARIS

- 3 pilot locations in Paris
- -3dB on road, -2dB on façade after 3 ans