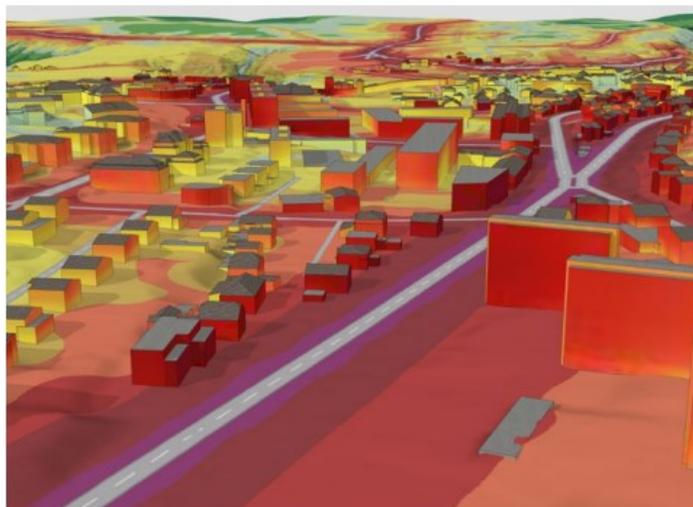


# Noise – Health - Regulation

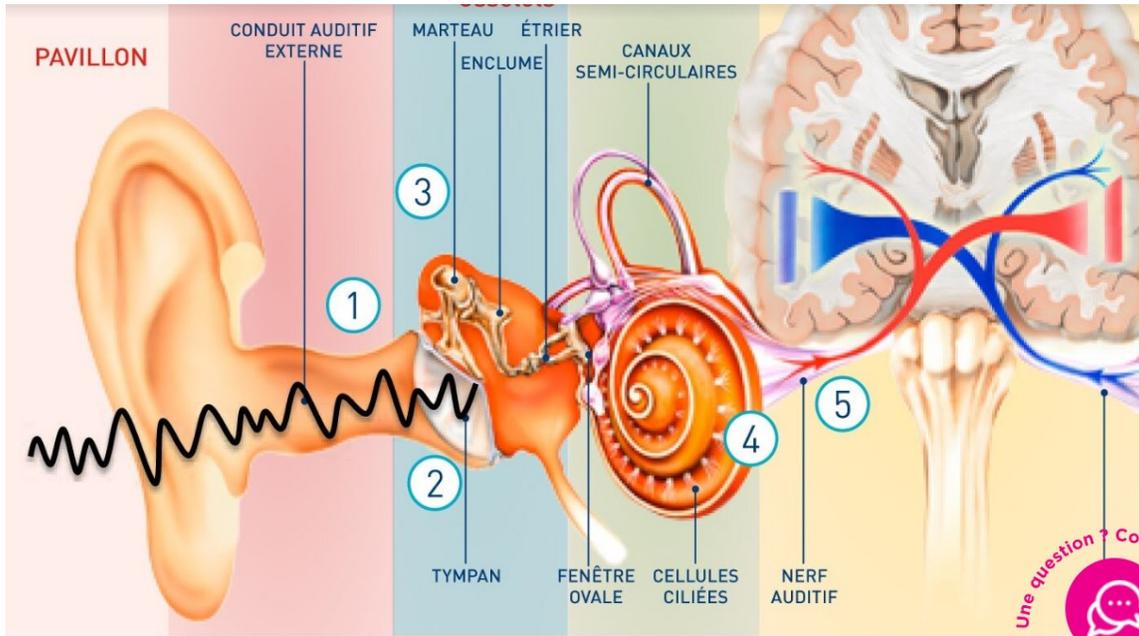


Source : OFEV (pollution sonore); swisstopo (swissTLM<sup>3D</sup>: Routes, swissBUILDINGS<sup>3D</sup>)





## How does it work...since a very long time !



Evolution has programmed humans to perceive sounds as potential sources of danger



"Fight or Flight" reaction

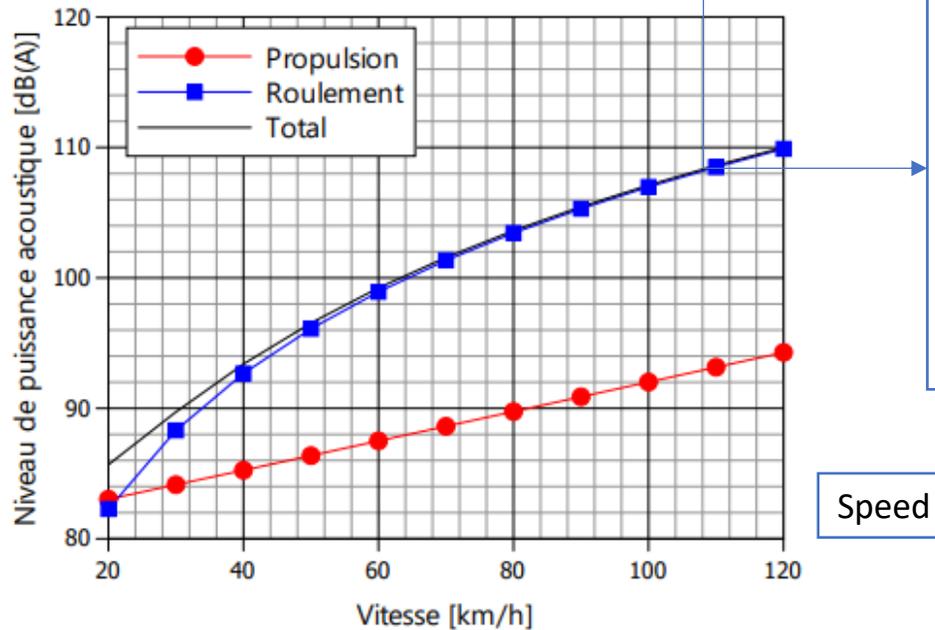




## One car passing by



Sound power level **at the car**

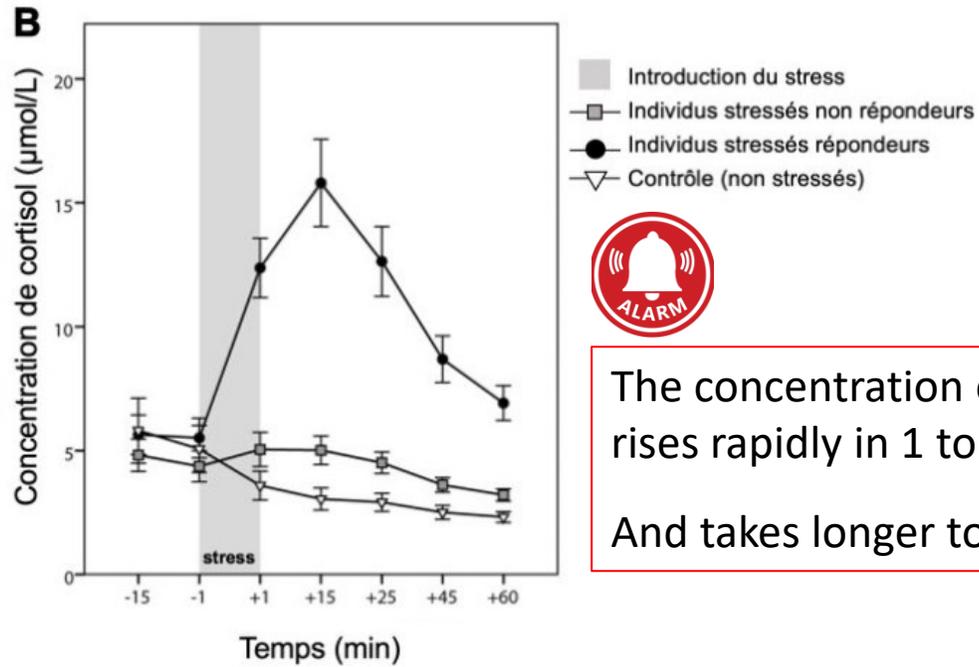


- These values are taken from **measurements of cars passing under real traffic conditions**
- These values are used for modelling Swiss noise emissions (sonROAD18)
- These values **do not represent** values according to common vehicle **measurement procedures**

Speed



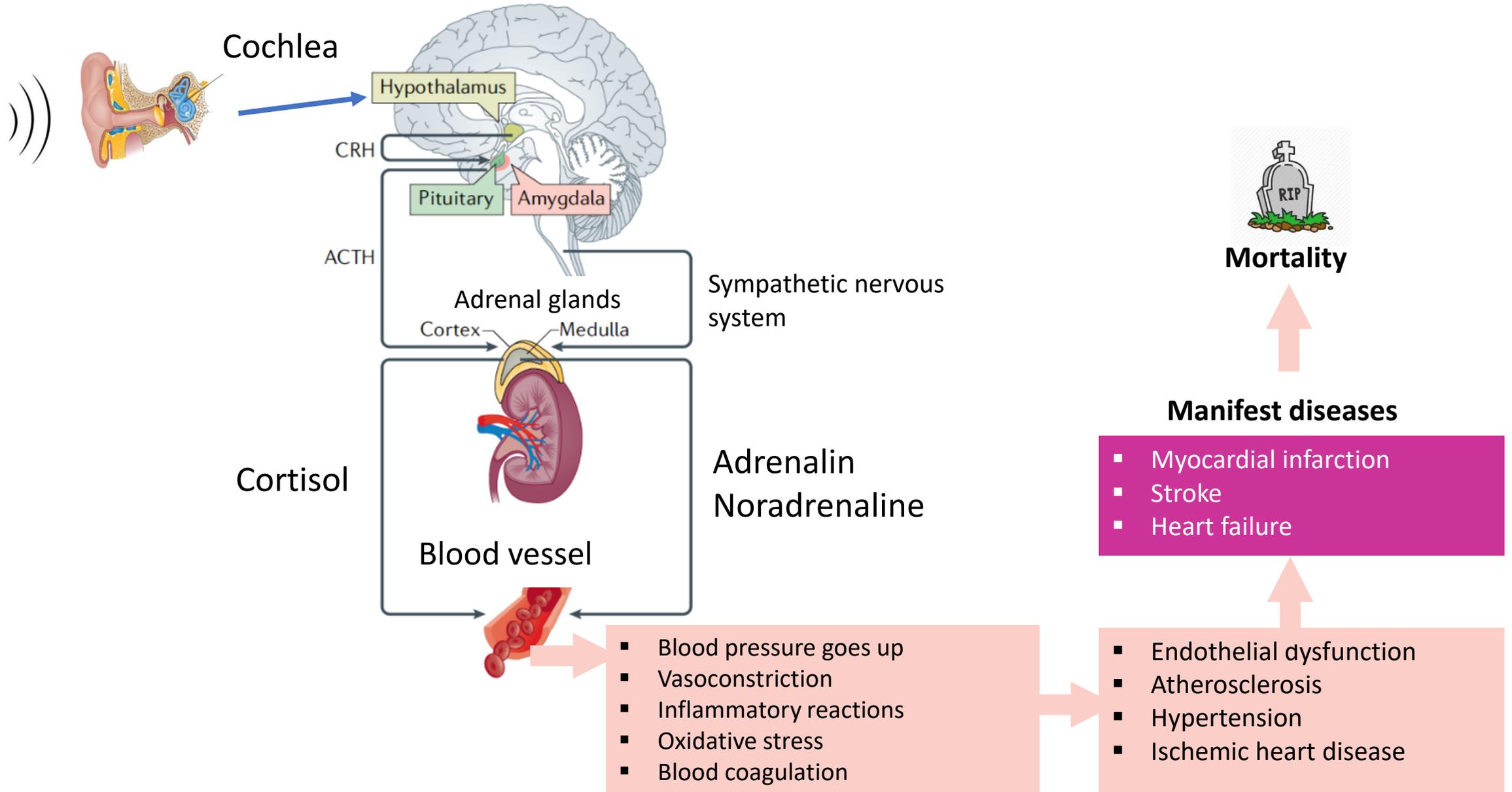
## One car passing by



The concentration of stress hormones rises rapidly in 1 to 15 minutes  
And takes longer to fall, over 60 minutes



# Cardiovascular effects of noise - pathophysiological pathway

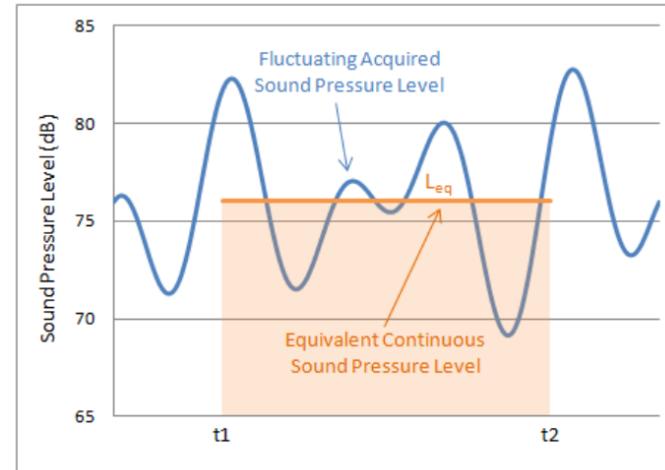
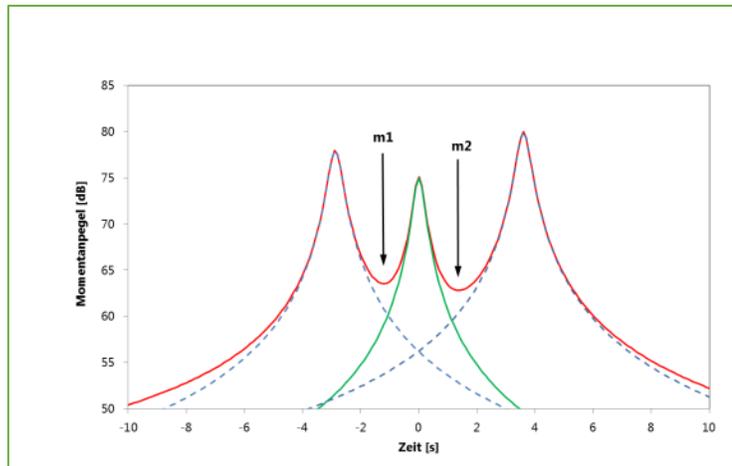




## Several cars passing by in one hour

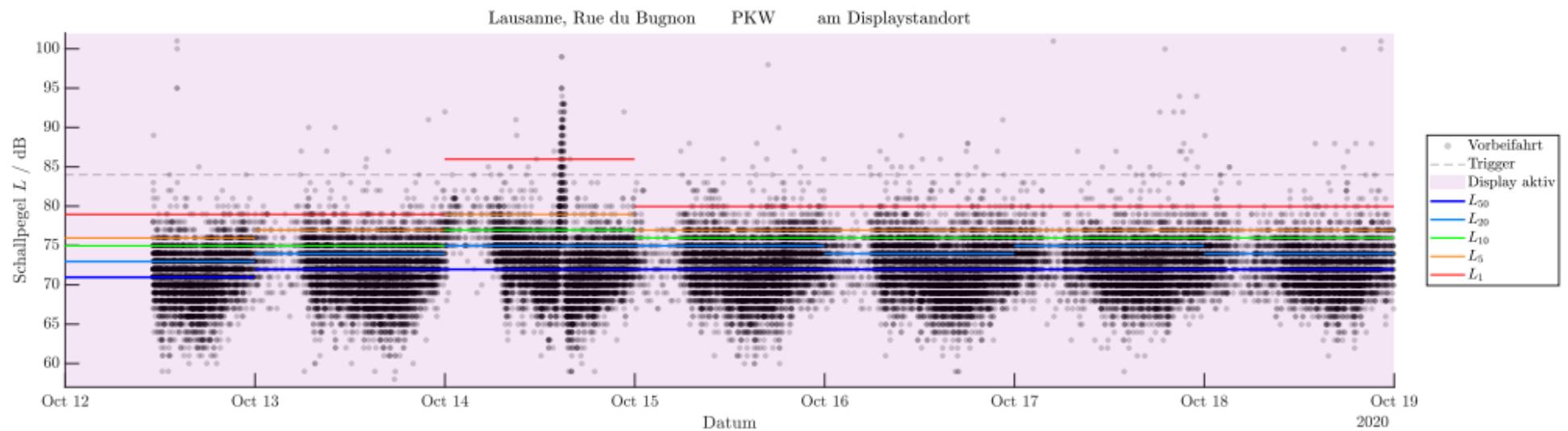
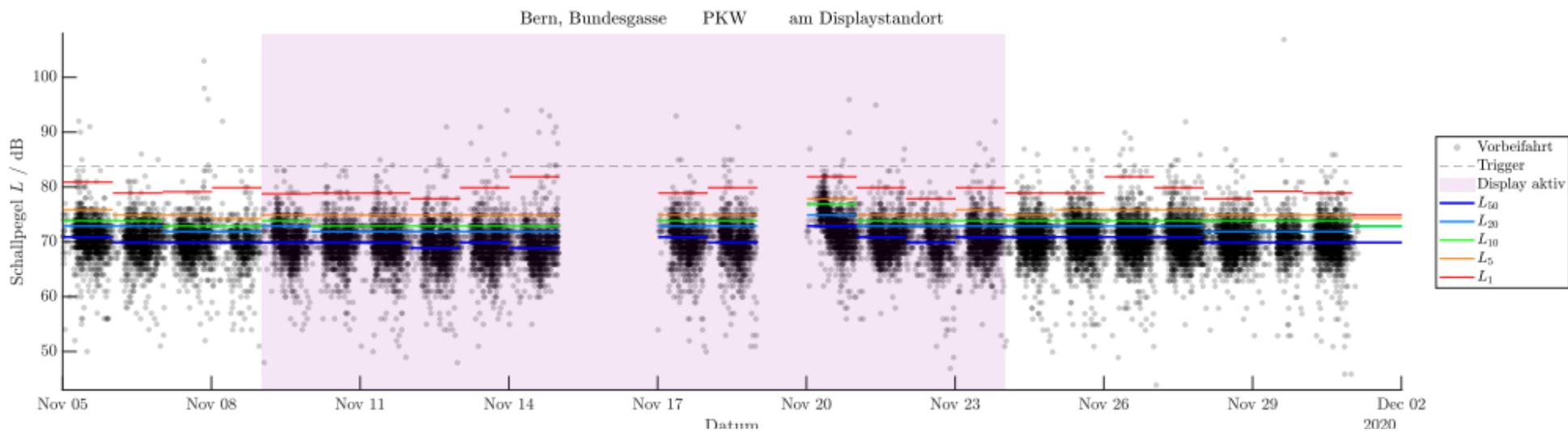


*Leq* = continuous sound pressure level which, over a given period of time, has the same amount of acoustic energy as the actual fluctuating noise





# Several cars passing by in one day / one week / ...



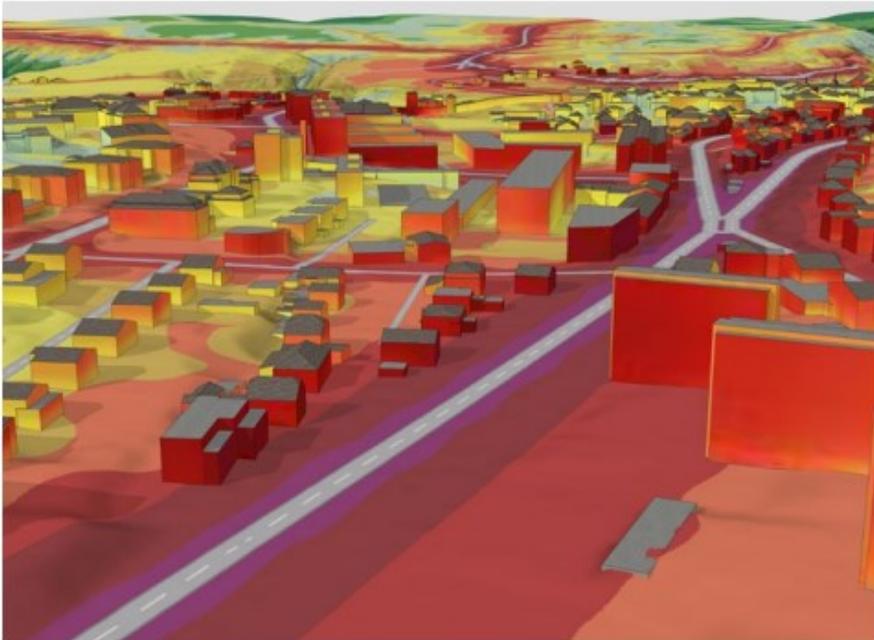


## Long term effects of noise exposition

Primary effect : awake, ECG agitation, acute rise in blood pressure

Secondary effect : tiredness, cognitive ability the next day

Tertiary effect : chronic hypertension, heart attack, Diabetes



Loss of healthy years  
Premature deaths

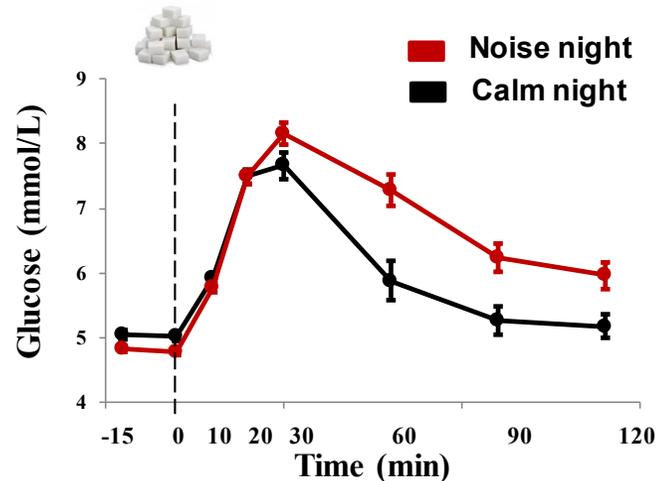
# Diabetes Type II - Pathways

## Pathophysiological pathway(s)

- Noise exposure leads to reactions of the autonomic nervous system (SNS, HPA-axis), commonly known as stress
- Stress reactions can trigger insulin resistance, which in turn leads to elevated glucose levels in the bloodstream
- If this condition persists, we call it diabetes type II
- Diabetes is an outcome that is investigated in epidemiological studies of noise effects

## Laboratory evidence

- Blood glucose elevated after oral glucose potion after a noisy night



Source: Thiesse et al.,  
Env Int, 2018



## Noise Pollution

The concept of exposome refers to the accumulation of exposure to environmental factors

It belongs, like air pollution, to the exposome of a person

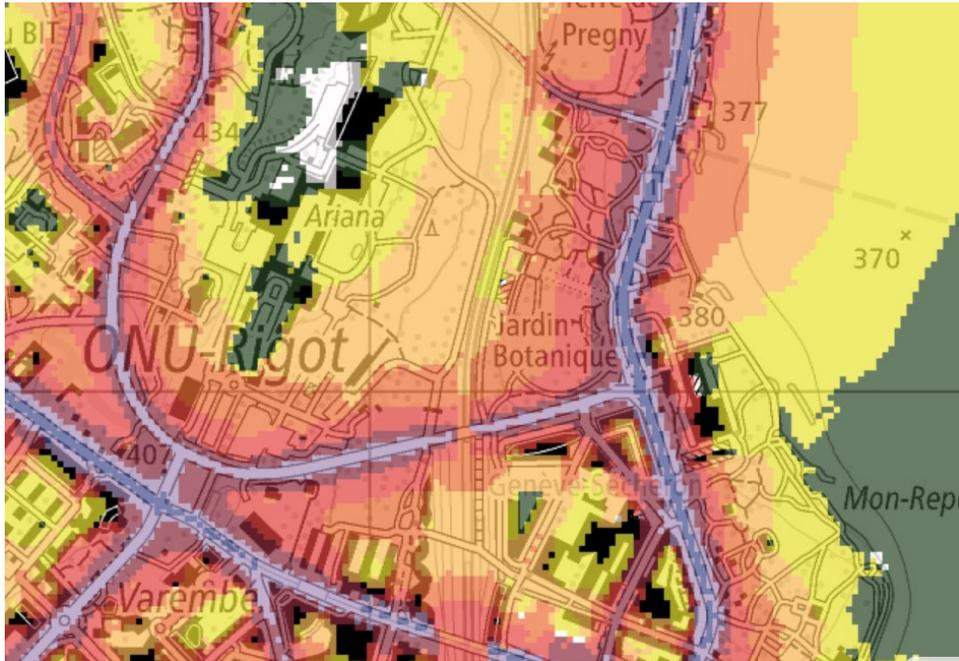
The number #1 source of noise pollution in the world is road traffic noise

The empirical evidence for these effects is clearly documented in thousands of scientific studies, carried out since decades.

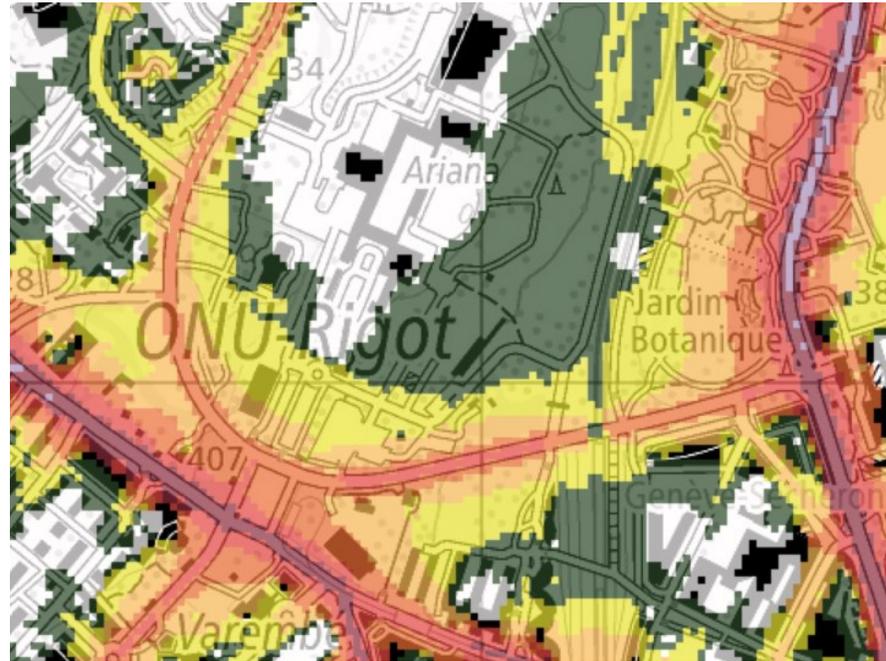
Much of the underlying biology linking noise to cardiovascular and metabolic outcomes is well described



## Monitoring – sonBASE Federal Office for the environment



Noise exposition during the day



Noise exposition during the night



## Monitoring – sonBASE Federal Office for the environment



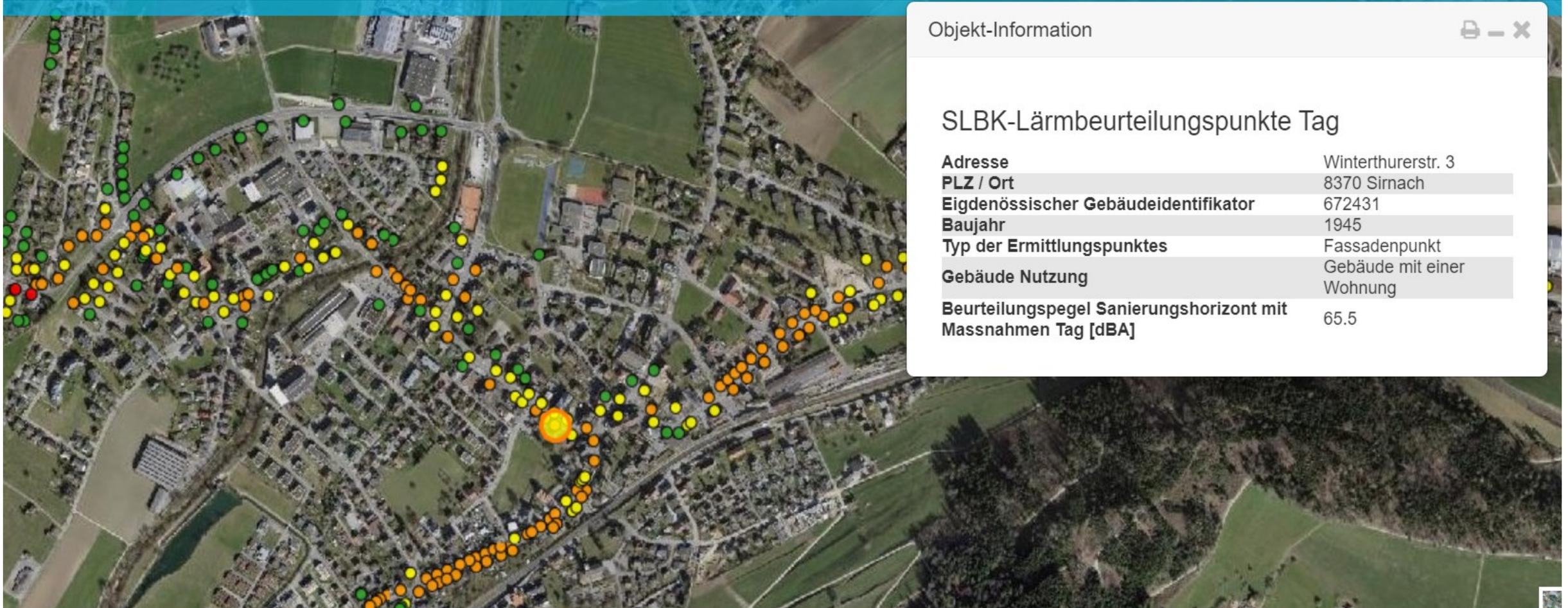
Noise exposition during the day



Noise exposition during the night



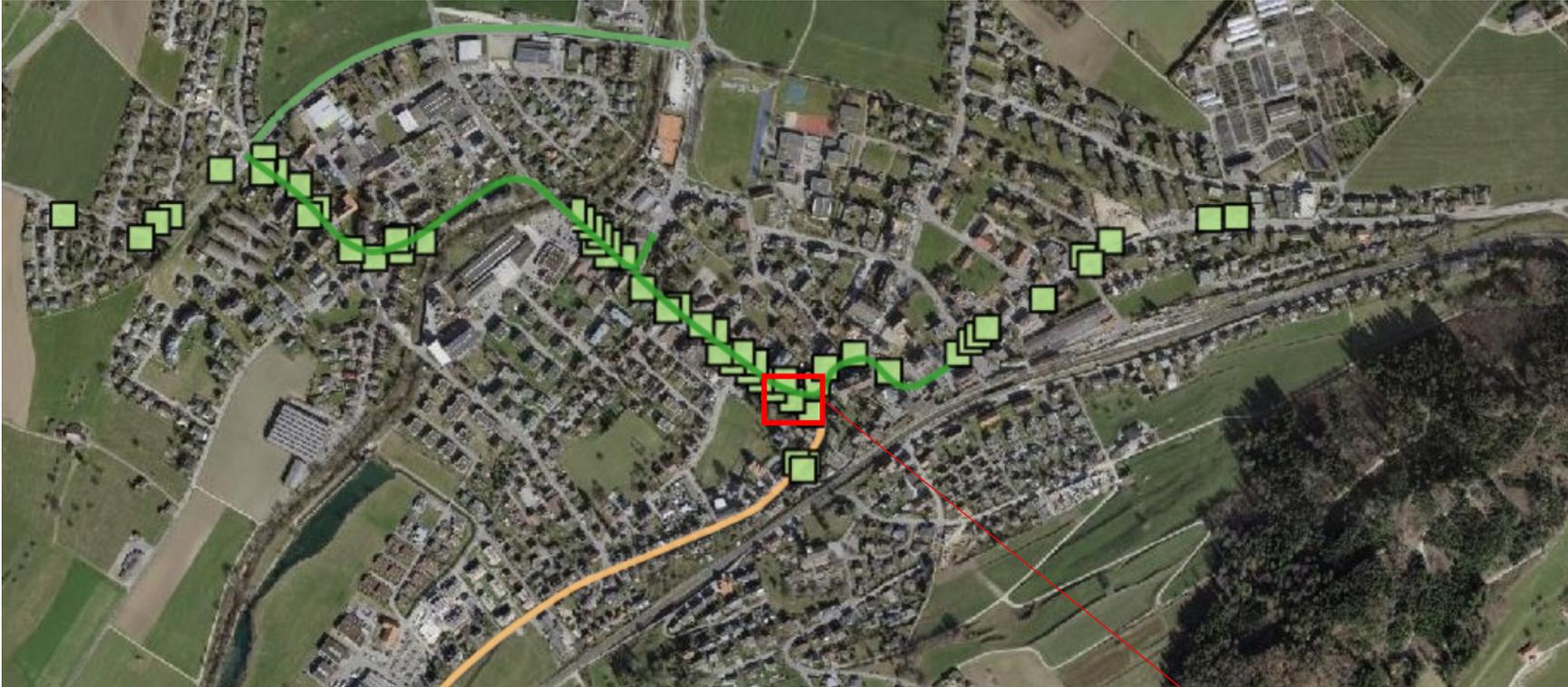
## Monitoring – Example Canton Thurgau



Noise exposition during the day



## Monitoring – Protection against noise Canton Thurgau



Noise protection during day and night :

Yellow line : low-noise pavement

Green line : speed reduction

Green square: isolation window

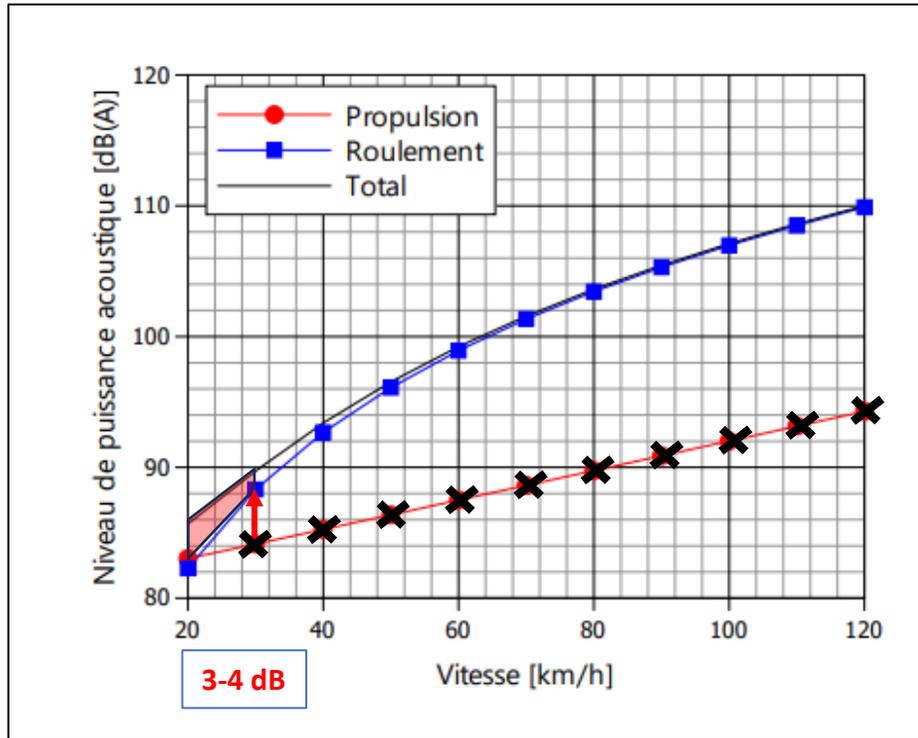
Speed reduction  
but still over the noise limits

From this point of view, no need for  
more noise !



# Noise for security

Sound power level at the car



For 1 “standard” combustion car at 25- 30 km/h, rolling noise:

- about 88 dB
- propulsion noise is about 84 dB
- dominates with about 3-4 dB, which is a little more than twice as loud (twice the acoustic energy)

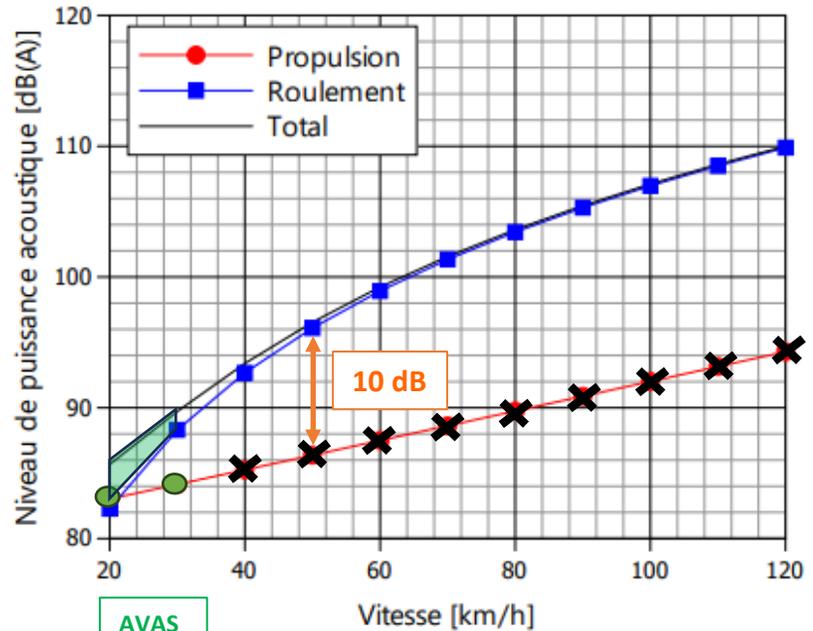
For 1 Electric car at 30km/h without AVAS:

- Rolling noise is about 88 dB
- Propulsion noise is not present
- **Reduced security because part of the alarm is missing**



## Noise and health

Sound power level at the car



For 1 Electric car at 25-30 km/h with AVAS:

- Rolling noise is about 88 dB
- AVAS is a different sound from power unit noise, but acts as a safety alarm

For significantly different noise levels, about 10dB and more, the louder noise masks the quieter noise

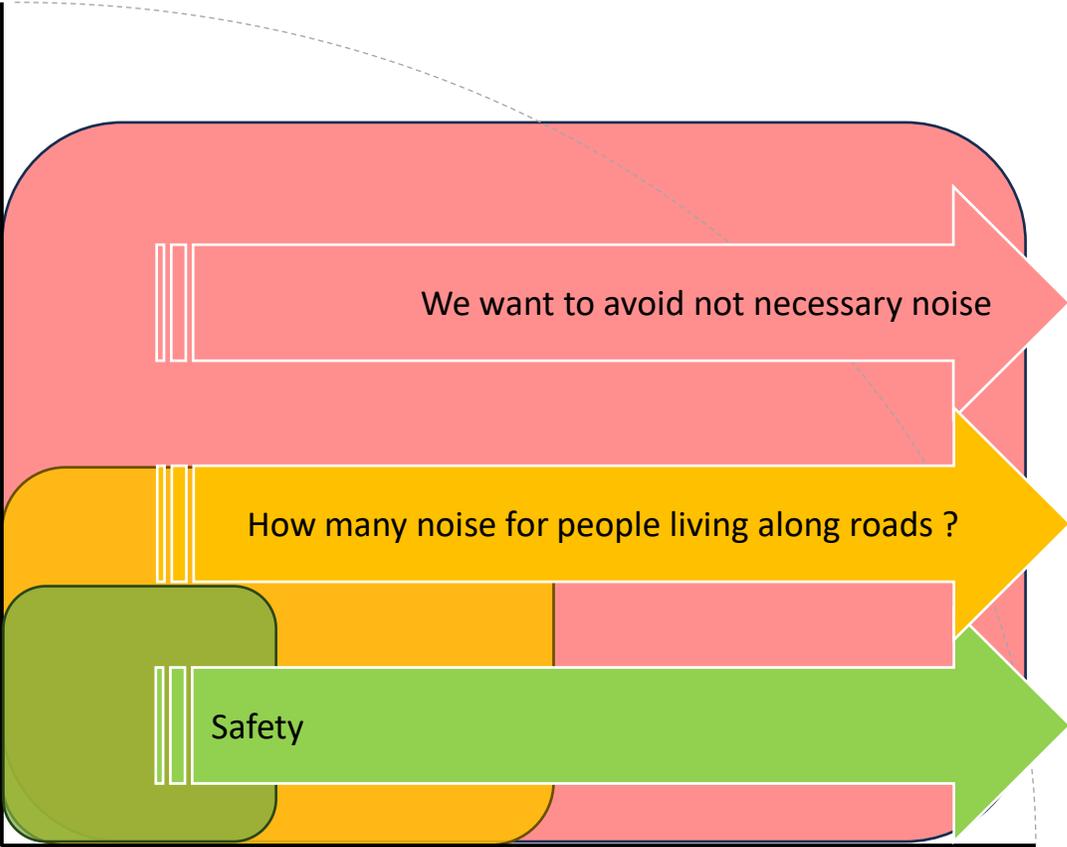
At 40 - 50 km/h, the rolling noise dominates the power unit noise by 10 dB, which makes it inaudible

Once the vehicle is making a sufficient sound through its tires, there is no need for propulsion or artificial noise – no need for a security alarm, the extra noise will have a negative impact on health

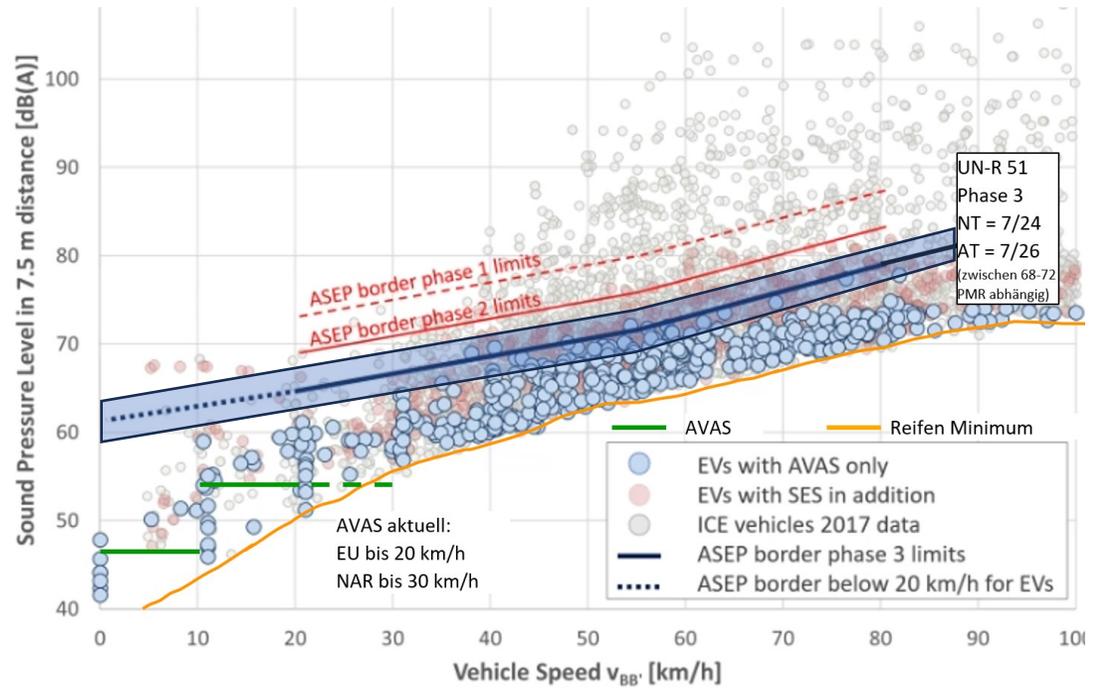


# Translation of “environmental” noise into the homologation system

## Electric Cars

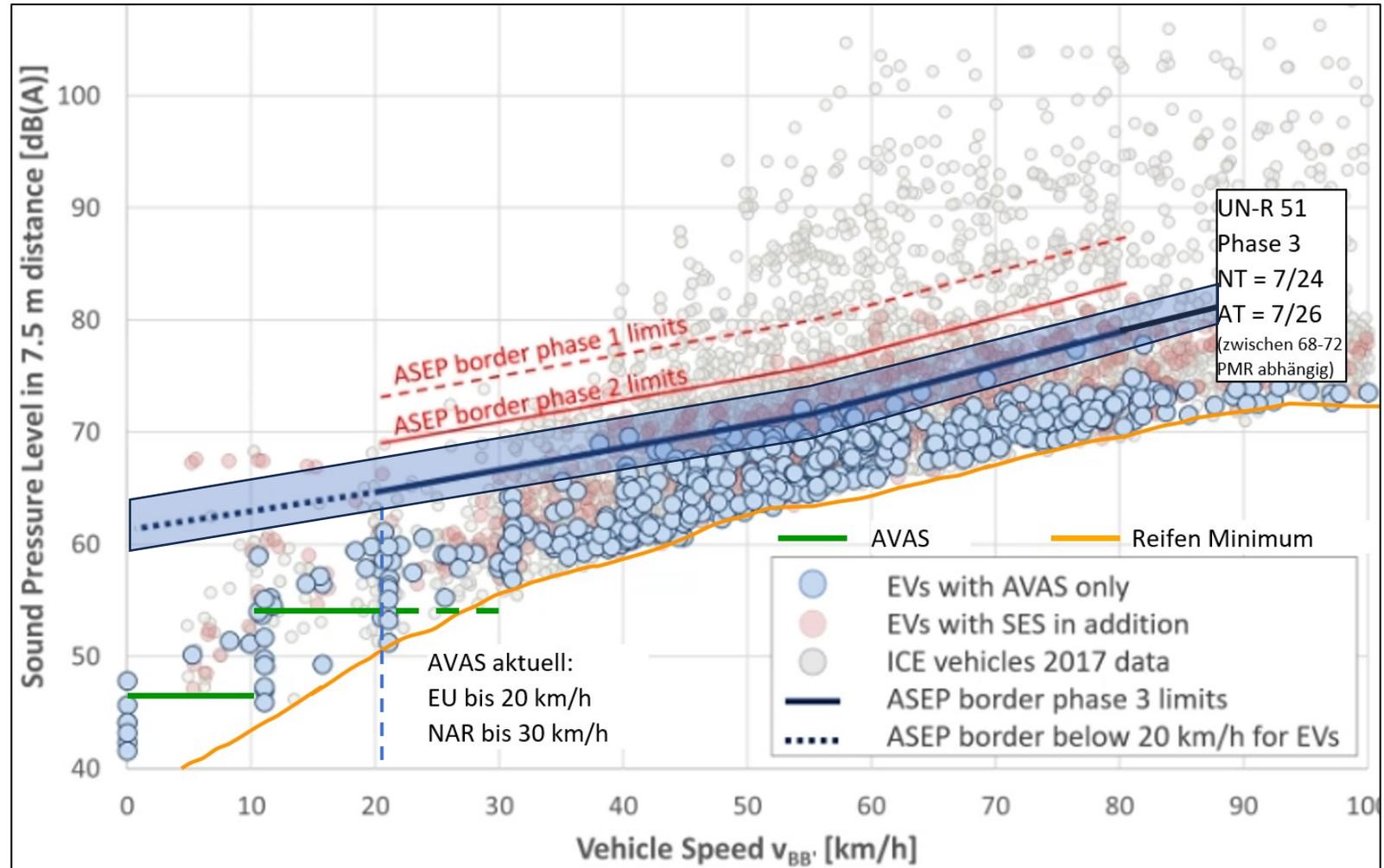
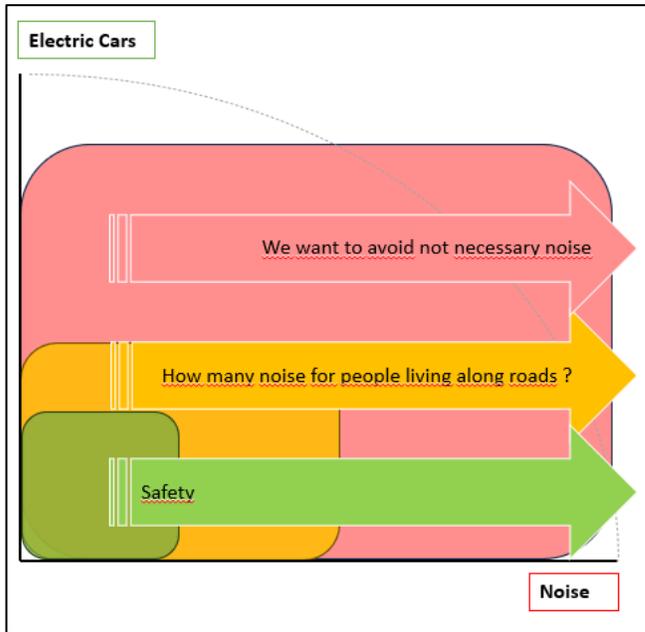


Noise



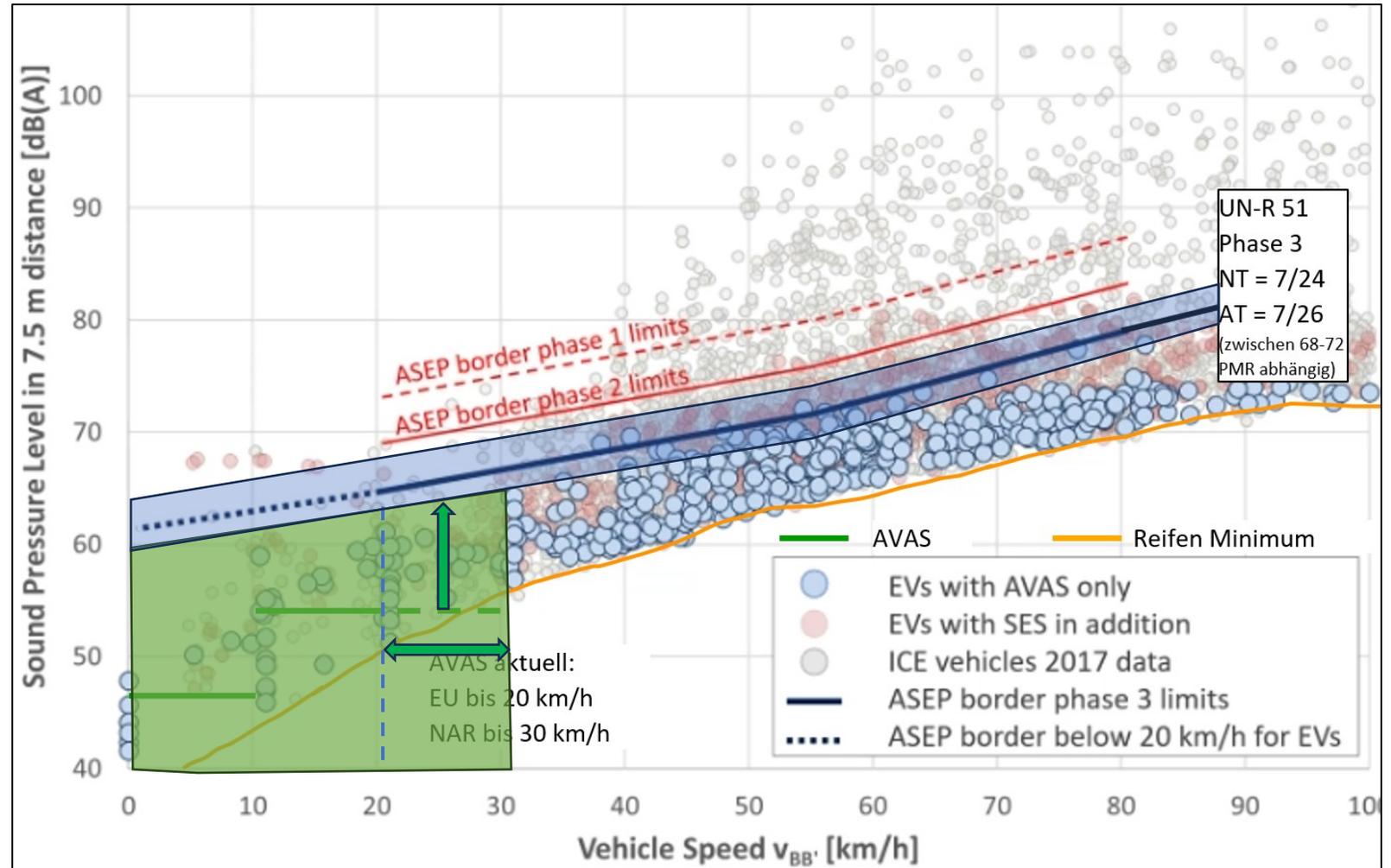
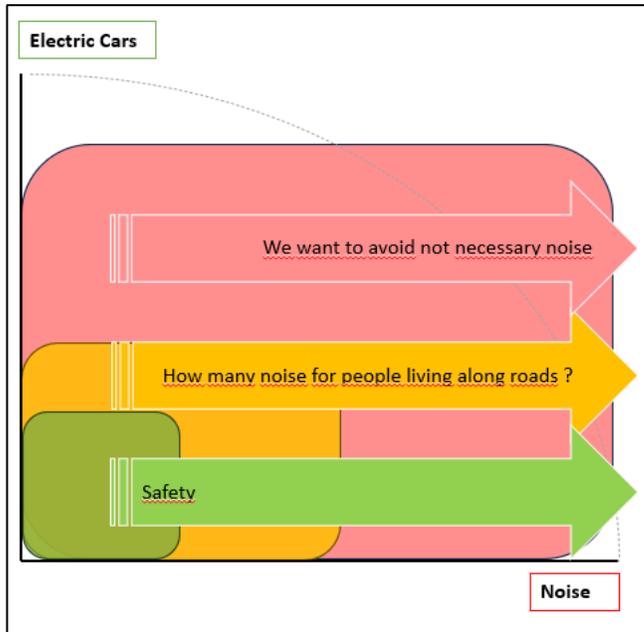


# Translation of "environmental" noise into the homologation system



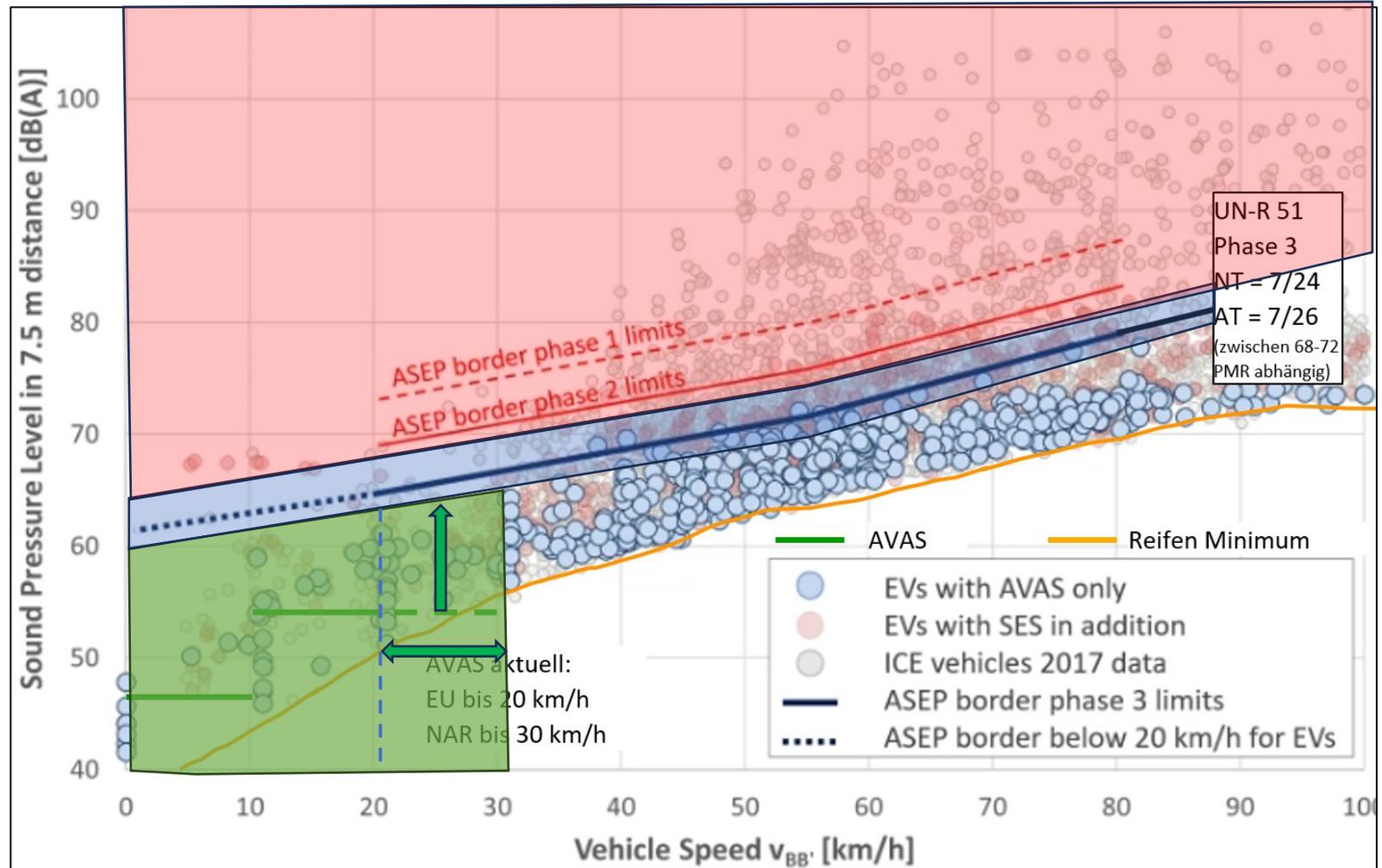
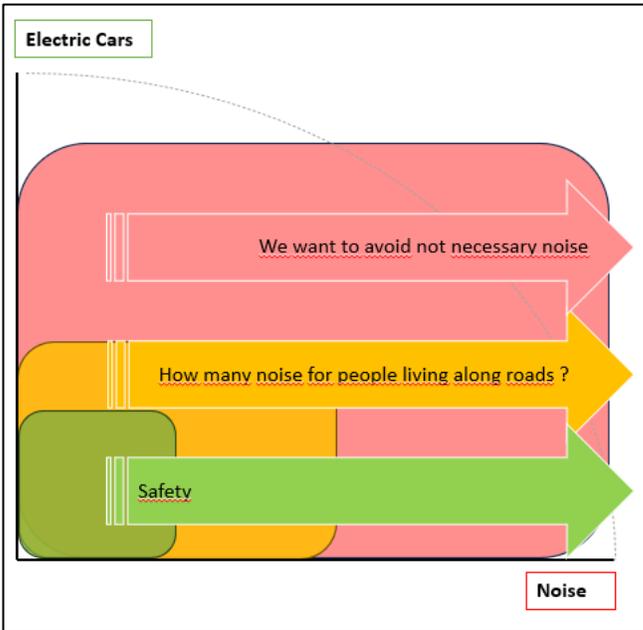


# Translation of "environmental" noise into the homologation system



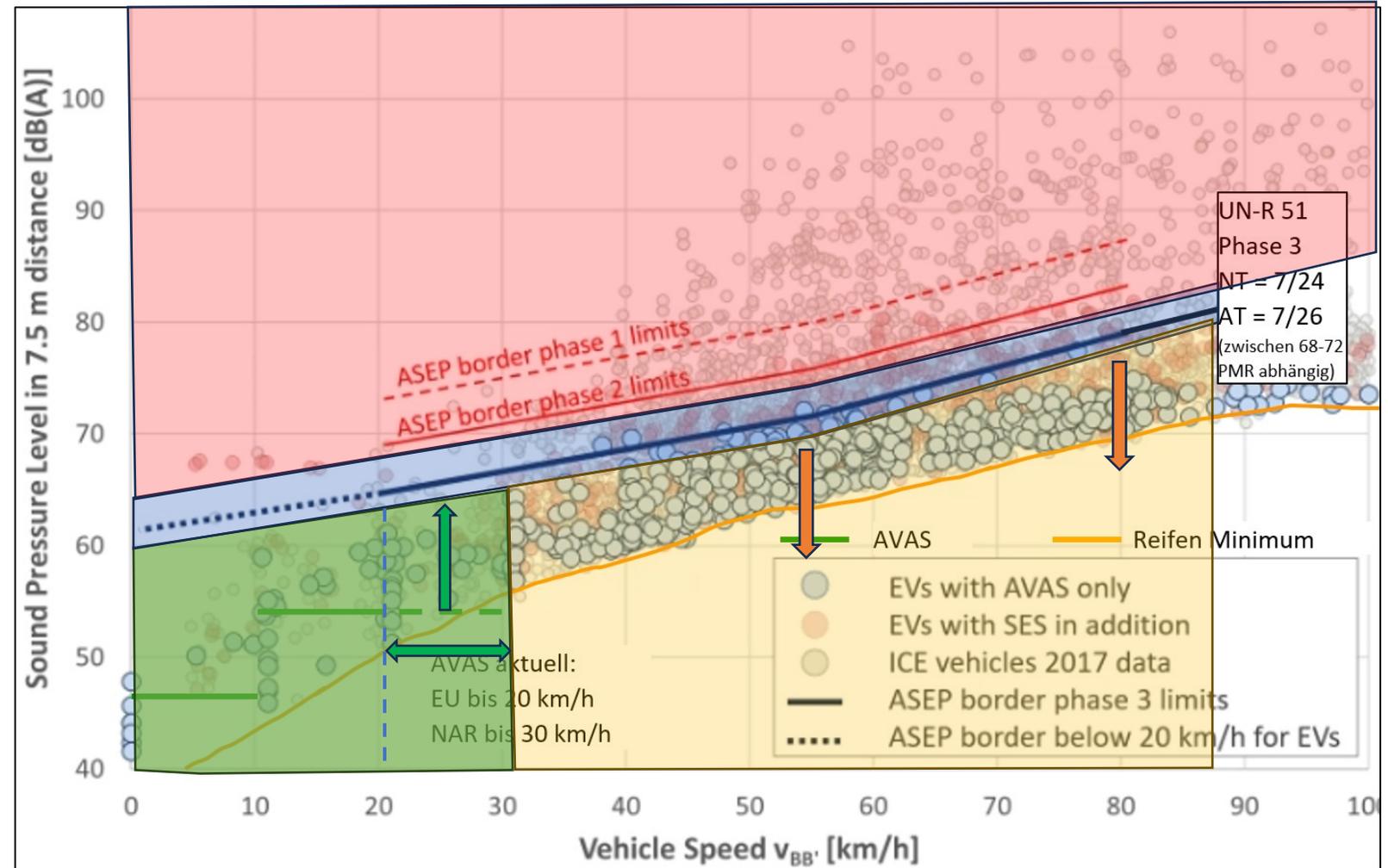
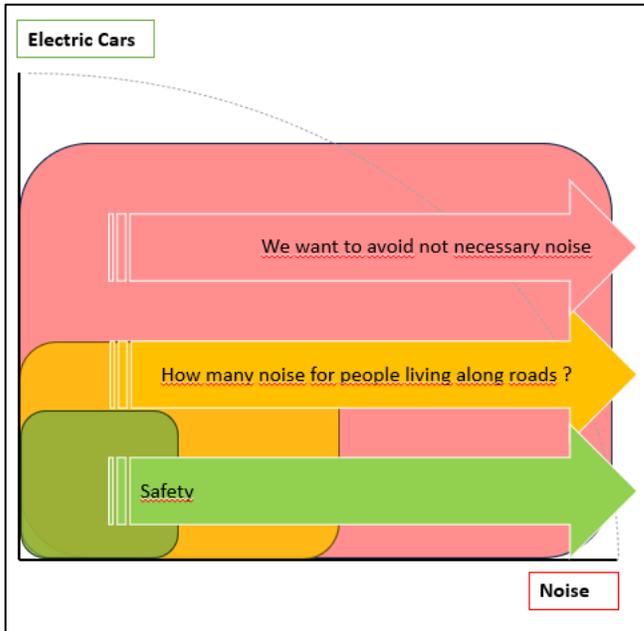


# Translation of "environmental" noise into the homologation system





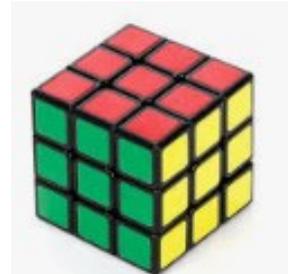
# Translation of "environmental" noise into the homologation system





# Noise – Health - Regulation

Thank you for your attention

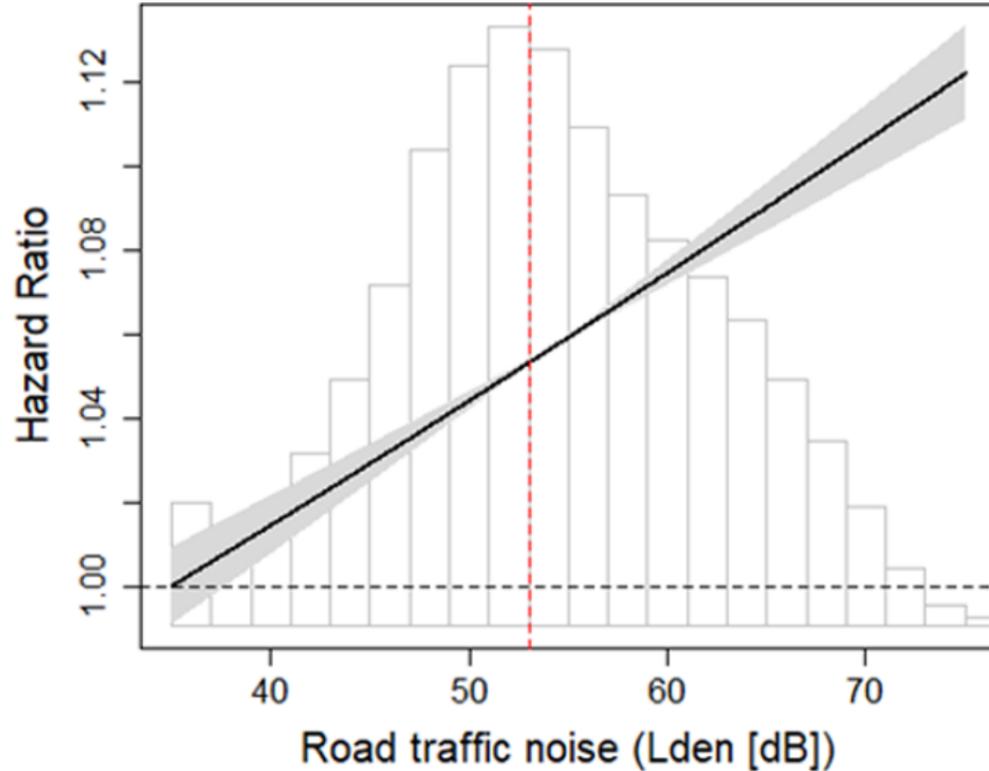


# Questions ?

Back up

## Cardiovascular effects of noise

### *Noise-induced mortality from all cardiovascular diseases in Switzerland*



An increase in road noise of 30 to 75 dB increases the risk by 12% in Switzerland

L<sub>day</sub> = Leq day 6h-22h  
L<sub>night</sub> = Leq night 22h-6h  
L<sub>den</sub> = Leq day-evening-night, focused on the importance of protecting people in the evening and night period

Source: Vienneau et al. (2022). "Transportation noise exposure and cardiovascular mortality: 15-years of follow-up in a nationwide prospective cohort in Switzerland." *Environ Int* **158**: 106974.