# Sound Masking Design during Acceleration/Deceleration of EV in Consideration of Audio-Visual Stimuli and Driving Intention

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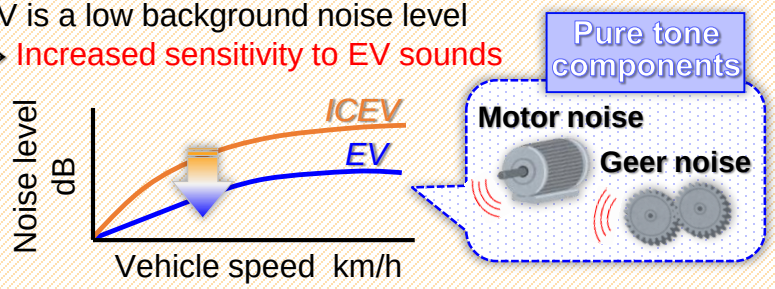
## Background

### Sound issue with the EV shift

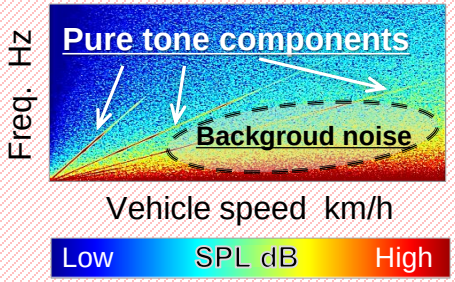
EV is a low background noise level
→ Increased sensitivity to EV sounds




## Purpose

### Establishment of design guidelines

Construction of design guidelines based on masking of pure tone components by background noise



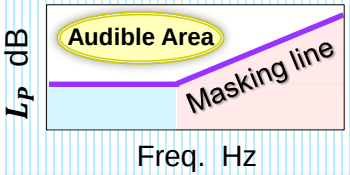

Construct in 3 steps

- Sound level design of pure tone components
- Sound quality design for background noise
- Design under combined sensory stimuli

## Content

### STEP1 : Sound level design of pure tone components

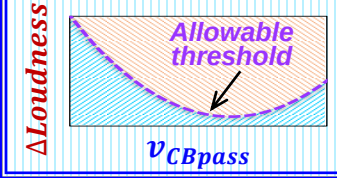
**Areas without resonance**




Guidelines

$$L_P = A\log_{10} f + B \ [\mathrm{dB}]$$

**Areas with resonance**

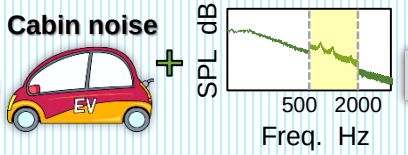



Guidelines

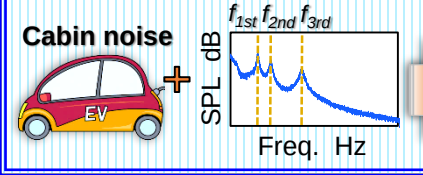
$$\Delta Loudness = AX^2 - BX + C \ [\mathrm{sone}]$$

### STEP2 : Sound quality design for background noise

**Driving feeling by sound masking**




**Acceleration feeling by baseline sound**




### STEP3 : Design under combined sensory stimuli

**Experiment with DS**

- Auditory …Motor noise etc.
- Visual …Speed changes etc.
- Operation …Pedal operation etc.