

Japan Suggestions for AVAS sound requirements

JASIC

1. Outline

- Japan suggestions for the sound requirements for AVAS:
 1. At least two bands with adequate sound pressure levels in 1/3 octave band,
 2. Audible distance should be proportional to AVAS's overall sound pressure level.
- ⇒ Japan conducted verification tests.

2. Review of Previous Presentation

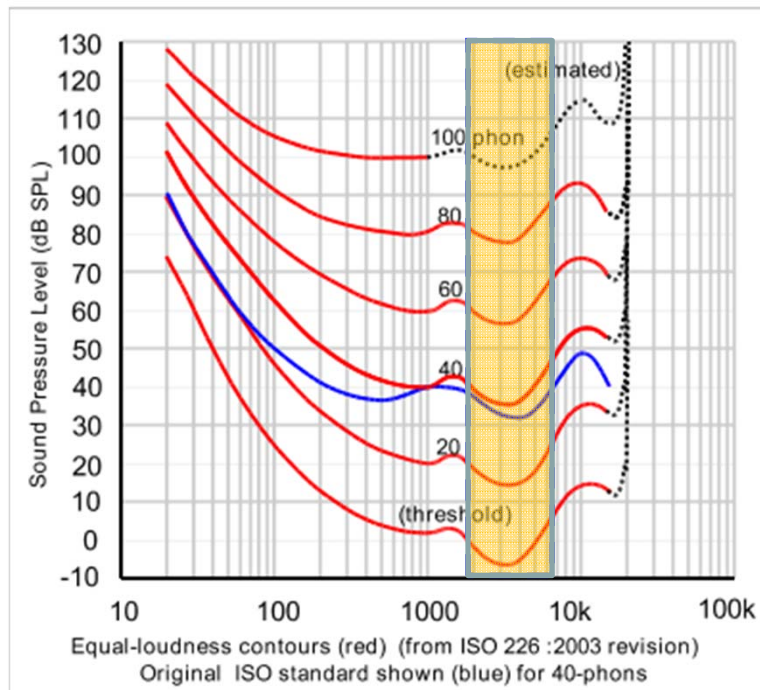
Sound for all Pedestrian

Quoted from Informal document
No. **GRB-52-18** (52nd GRB,
6-8 September 2010.)

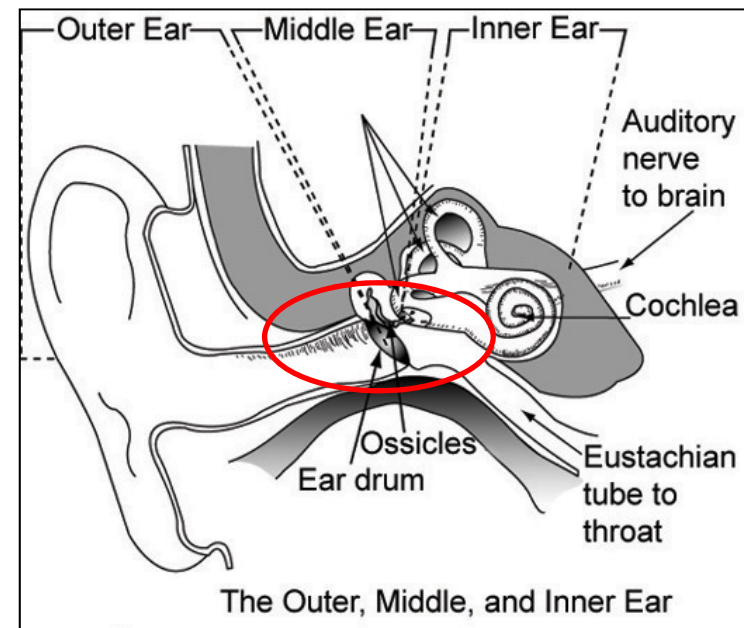
- For persons with normal hearing, the ear is most sensitive to frequencies between 1 and 5 kHz due to the resonance of the ear canal and the transfer function of the ossicles of the middle ear.

A

Outstanding band frequency between 1kHz and 5kHz is effective for providing good detectability for pedestrians.





Source: ISO Equal Loudness Curves (ISO 226):2003



Sound for elderly suffering from hearing loss by aging (most of visually impaired people)

- Elderly persons more than 60 years old have difficulty in detecting sounds higher than 2kHz due to age related hearing loss.
- More than 70% of visually impaired are over 60 years old.

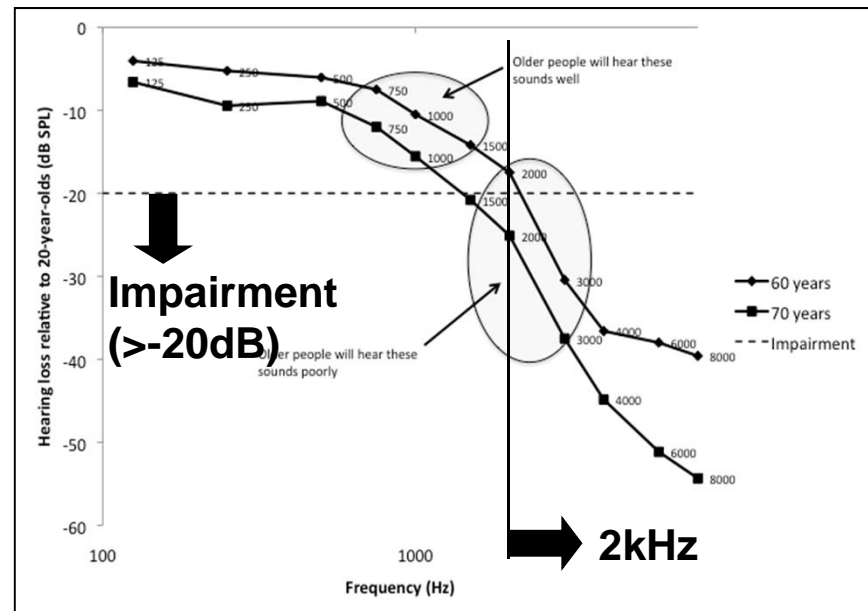
B AVAS needs outstanding band *under 1kHz frequency* to ensure good detectability for the majority of *blind people*.

	Population of Visually Impaired	impaired over 60 years old
	1.64 million	72%
	4.15 million*	73%

“Visually Impaired” includes people with “Legal Blindness” and “Low Vision”

Japan Data: Brant, M. Yamada et al (2010) Ophthalmic Epidemiology, 17(1), 50-57

US Data : National Eye Institute (NEI) “Prevalence of Blindness Data, *850,000 added to NEI estimate to account for ages <40 years based on Lighthouse International data

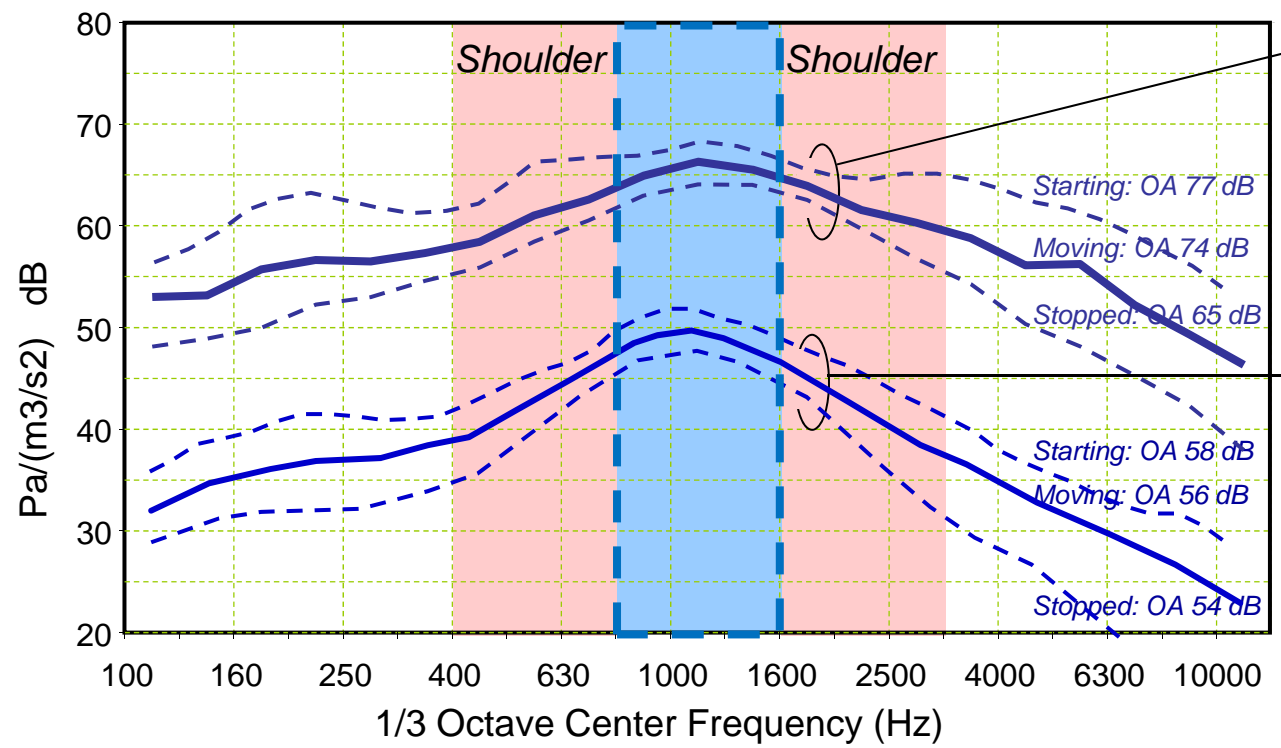


Sound for Neighborhood Community



- Ambient noise measurements taken at different locations in Detroit.
- Ambient noise has maximum level in 1kHz band for each traffic

C AVAS frequency bands at the 'shoulders of the 1 kHz band' will allow the lowest sound level possible while maintaining its effectiveness and a quiet environment for neighborhoods

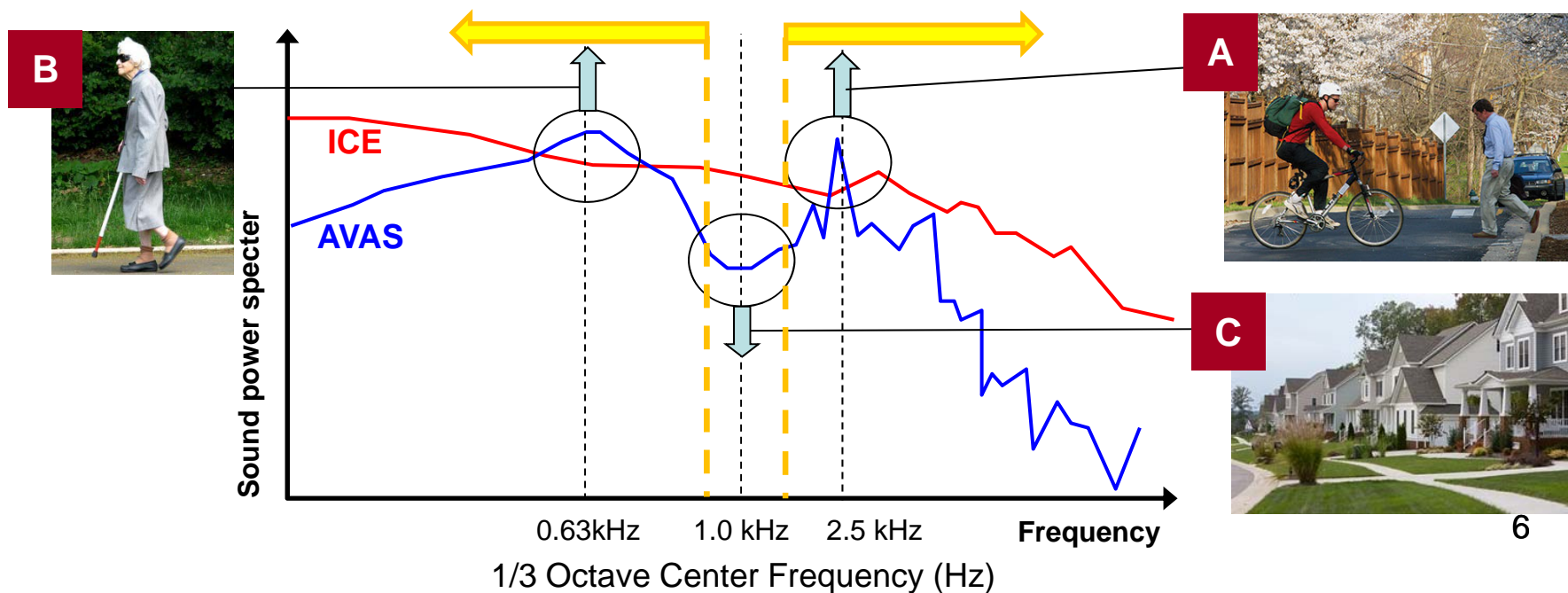


Japanese Two bands in 1/3 oct. Concept

A Outstanding band frequency *between 1kHz and 5kHz* is effective for providing good detectability for *all pedestrians but B*.

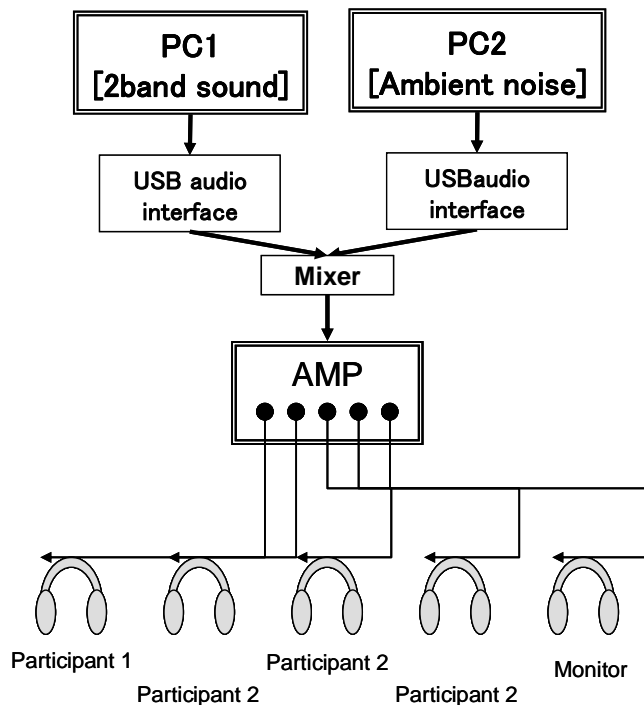
B AVAS needs an outstanding band *under 1kHz frequency* to ensure good detectability for elderly (*suffering from high-frequency hearing loss by aging*).

C AVAS frequency bands at the '*shoulders of the 1 kHz band*' will allow the lowest sound level possible while maintaining its effectiveness and a quiet environment for *neighborhoods*



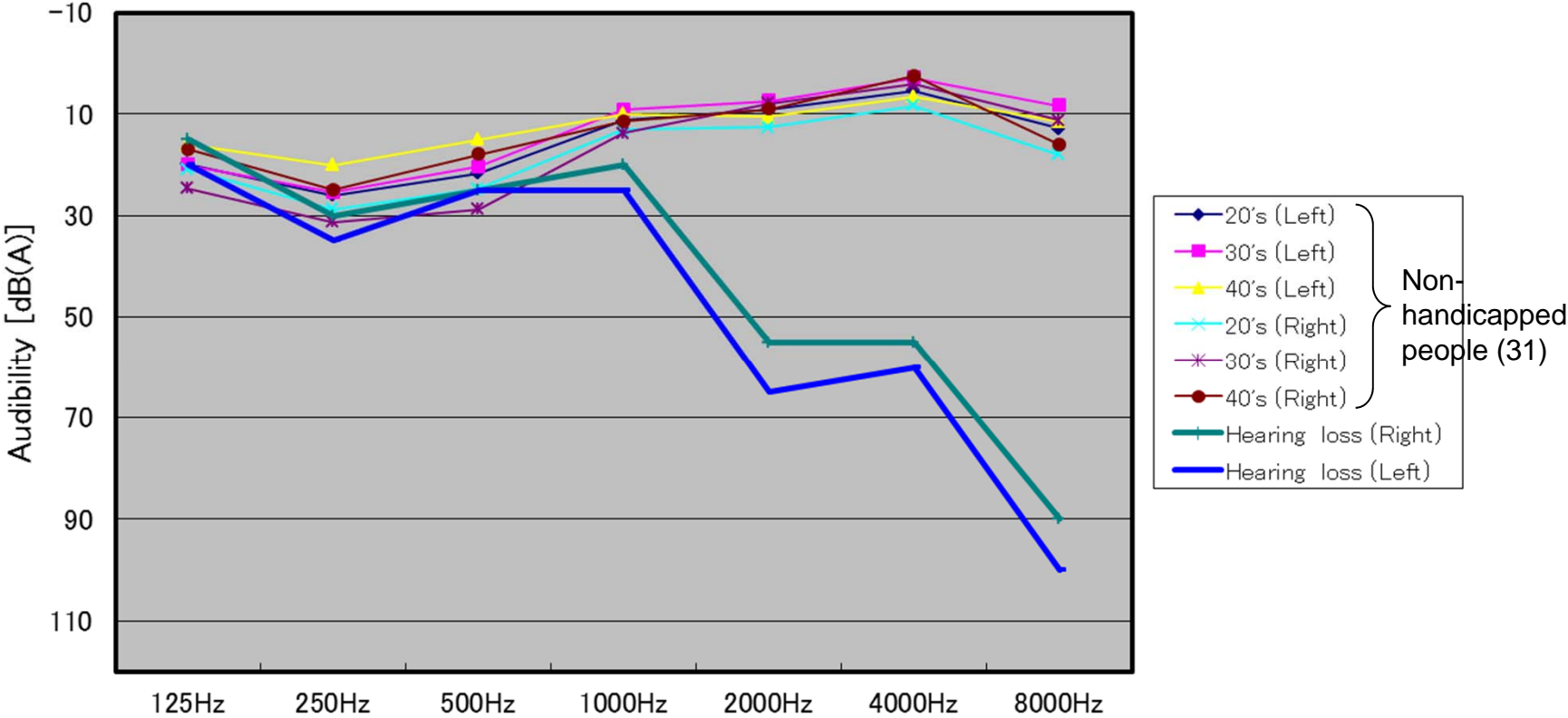
3. Indoor Hearing Test

- Participants : Non-handicapped people and a person who have the same type of hearing loss as the elderly.
- Test sounds: only 2 bands in 1/3 octave band (adjust to the same band level) \Rightarrow Mixed with ambient noise referred by NHTSA in NPRM \Rightarrow Present to participants



Hearing test

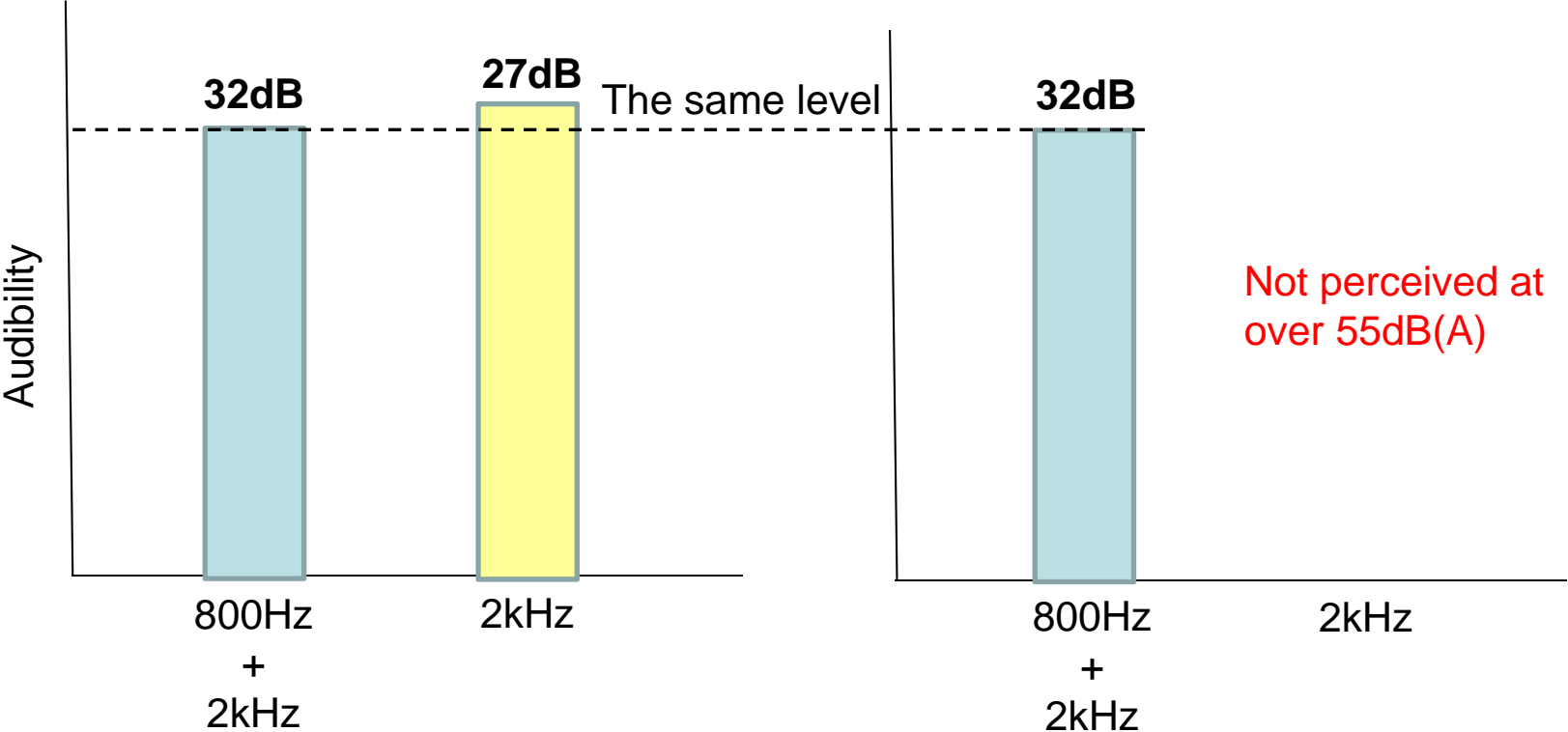
Results of pure tone audiometry



Results of Hearing Test

Non-handicapped

Person who have the same type of hearing loss as the elderly



High-frequency deafness cannot hear 2kHz even with the volume of 55dB.

⇒ **2 band bands in 1/3 octave band is essential.**

4. Validity Check for Audible Distance

- Examination: Relation between sounds with 2 band bands and O.A.
- Sounds: 2 band bands
200Hz + 2kHz, 200Hz + 5kHz,
800Hz + 2kHz, 800Hz + 5kHz
Volume: 46dB, 52dB, 58dB in O.A. (Target value)
Sounds are generated from a speaker fixed to EV.
⇒ Measurement of audible distance in driving at the speed of 10km/h
- Place: Japan Automobile Research Institute (JARI),
Shirosato Test Center (background noise; 25dB)
- Participants: 12 (Non-handicapped)



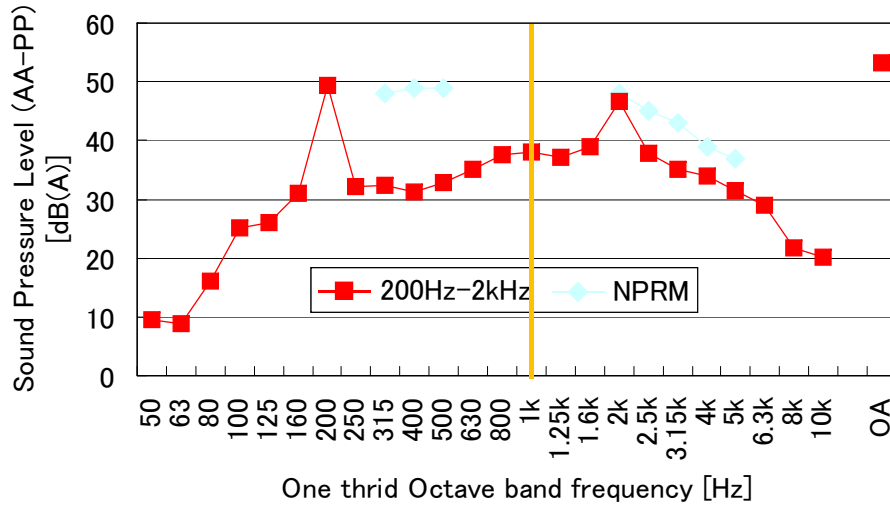
extremely
quiet

Speaker Setting

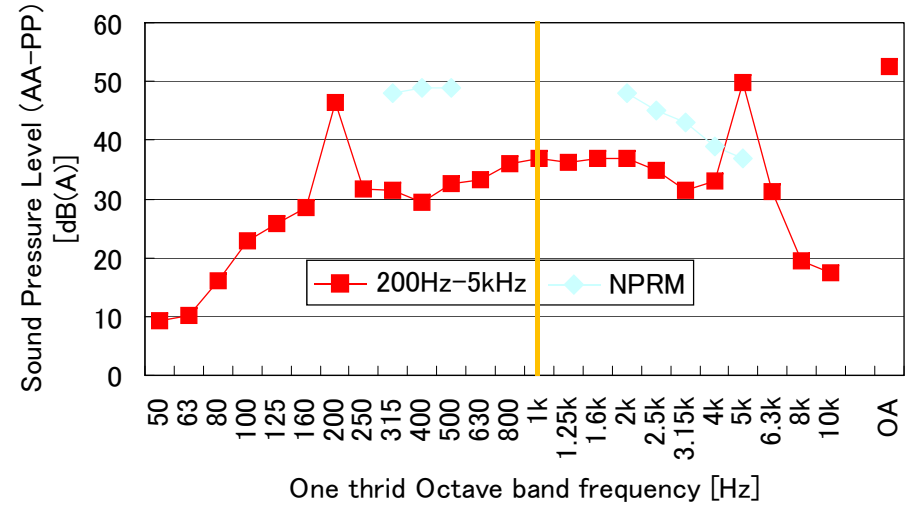


Speaker attached to the tip of EV

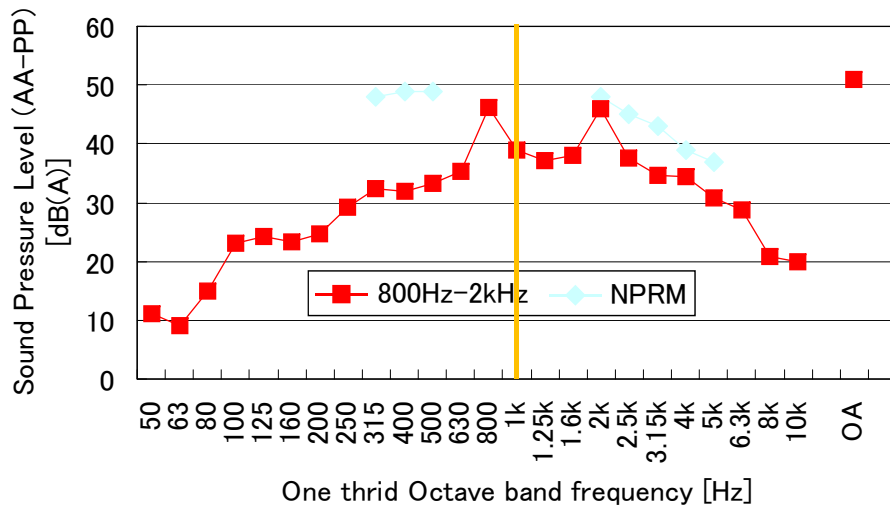
Pass-by Noise Spectrum (AA-PP Max. Level)



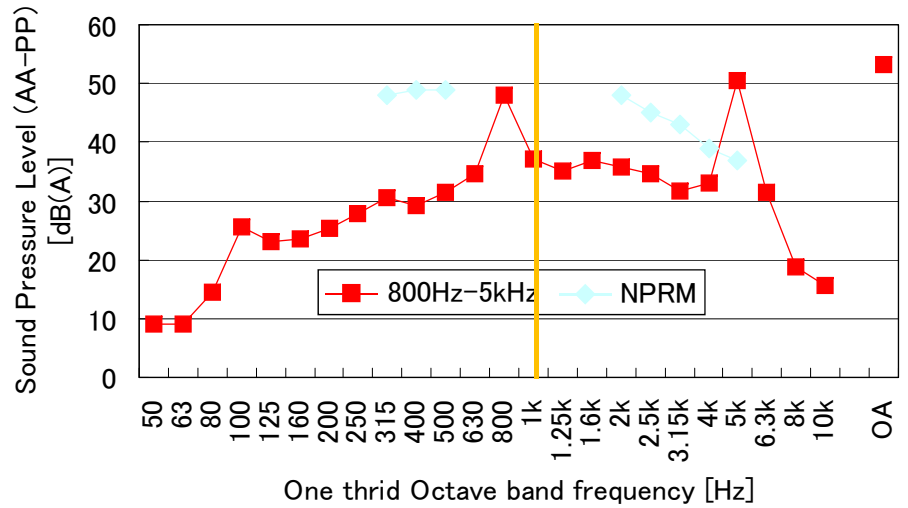
200Hz-2kHz



200Hz-5kHz

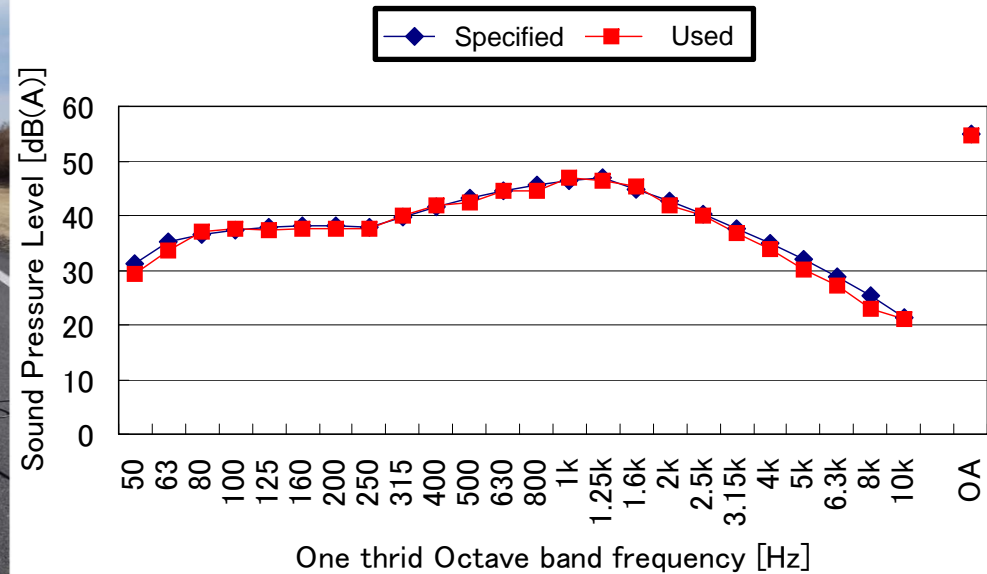
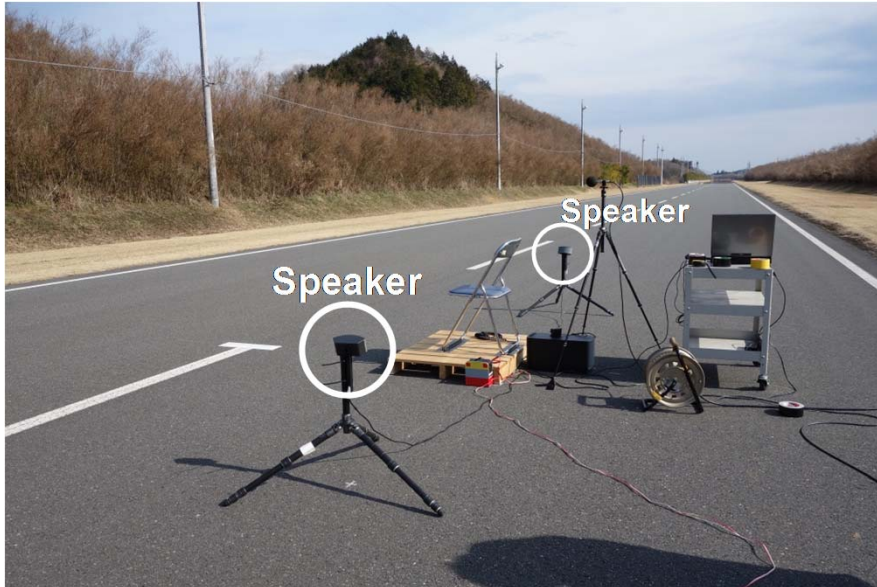


800Hz-2kHz



800Hz-5kHz

Audible Test Setting



NHTSA background noise emanates from two speakers. Adjust volume to 55dB around participants' ear.

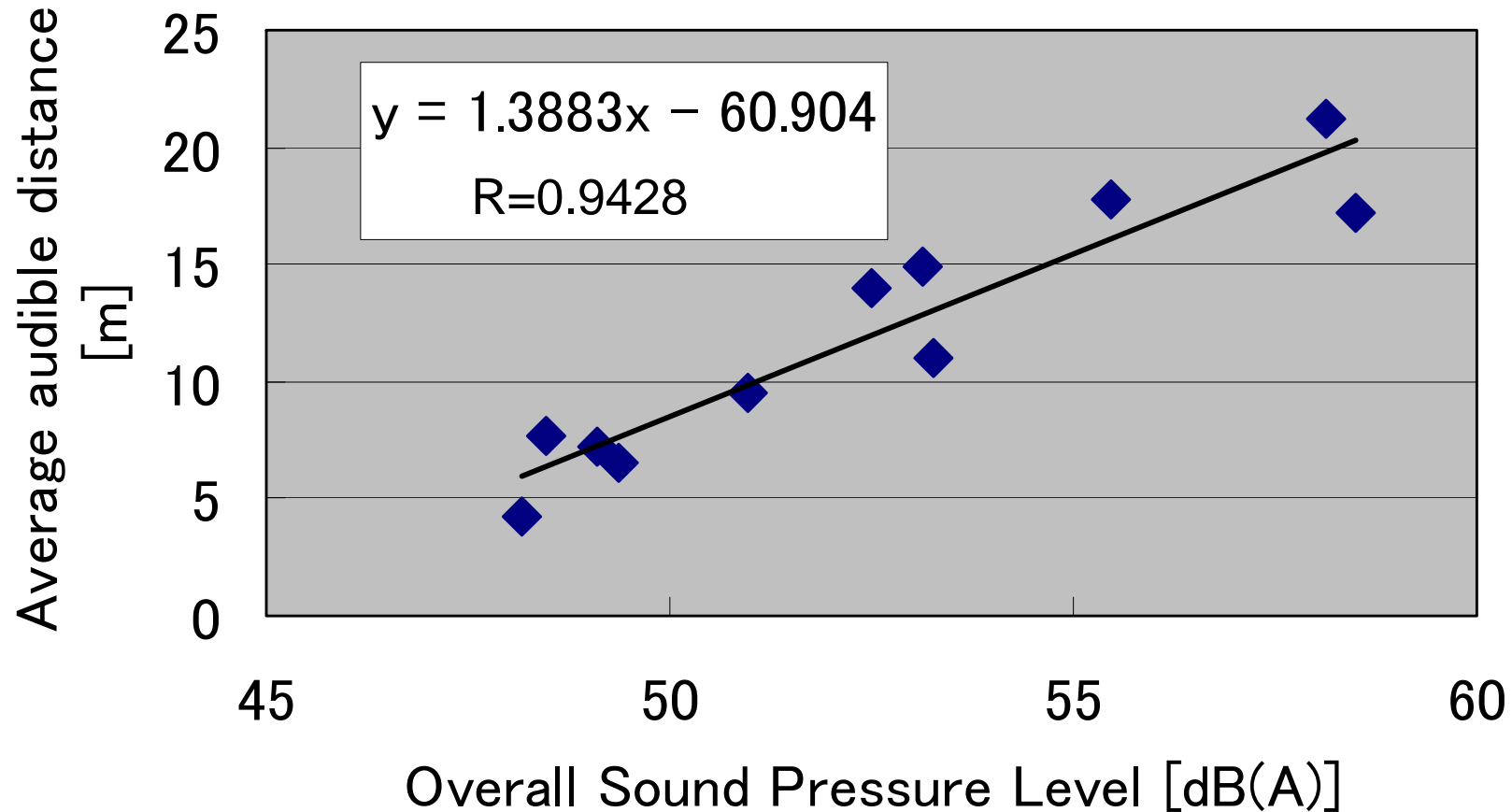
Comparison of frequency characteristics between NHTSA background noise and background noise from speakers

Audible Test Setting



Press switch when participants notice sounds.
Measurement of audible distance.

Test Result (Average of Audible Distance)



Verified audible distances of sounds with 2 band bands are proportional to O.A. under condition of background noise referred NHTSA in NPRM (55dB)

Conclusion

Japan suggestions for the sound requirements for AVAS:

1. At least 2 band bands in 1/3 octave band,
2. Audible distance should be proportional to O.A.

⇒ Japan conducted verification tests.

⇒ Japan verified 1. and 2.

Thank you very much
for your attention