Study of "Low level" lower limit

JASIC

BGN level of "Low level" usage situation （TFRWS-08-03）

1. In TFRA-04-11, there are sentences about the usage situations of 3 different sound level modes. The situations are defined as follows.

   > Low level : Quiet times (e.g. during 10 pm to 5 am)
   >   Quiet area
   > Normal level : Normal traffic hours (e.g. during 5 am to 10 pm)
   > High level : Very loud time and/or very loud place

   These sentences were deleted from present draft of new regulation.
   But TF still have common understanding.

2. Based on the above background, the followings are appropriate BGN levels when 3 different sound level modes are used.
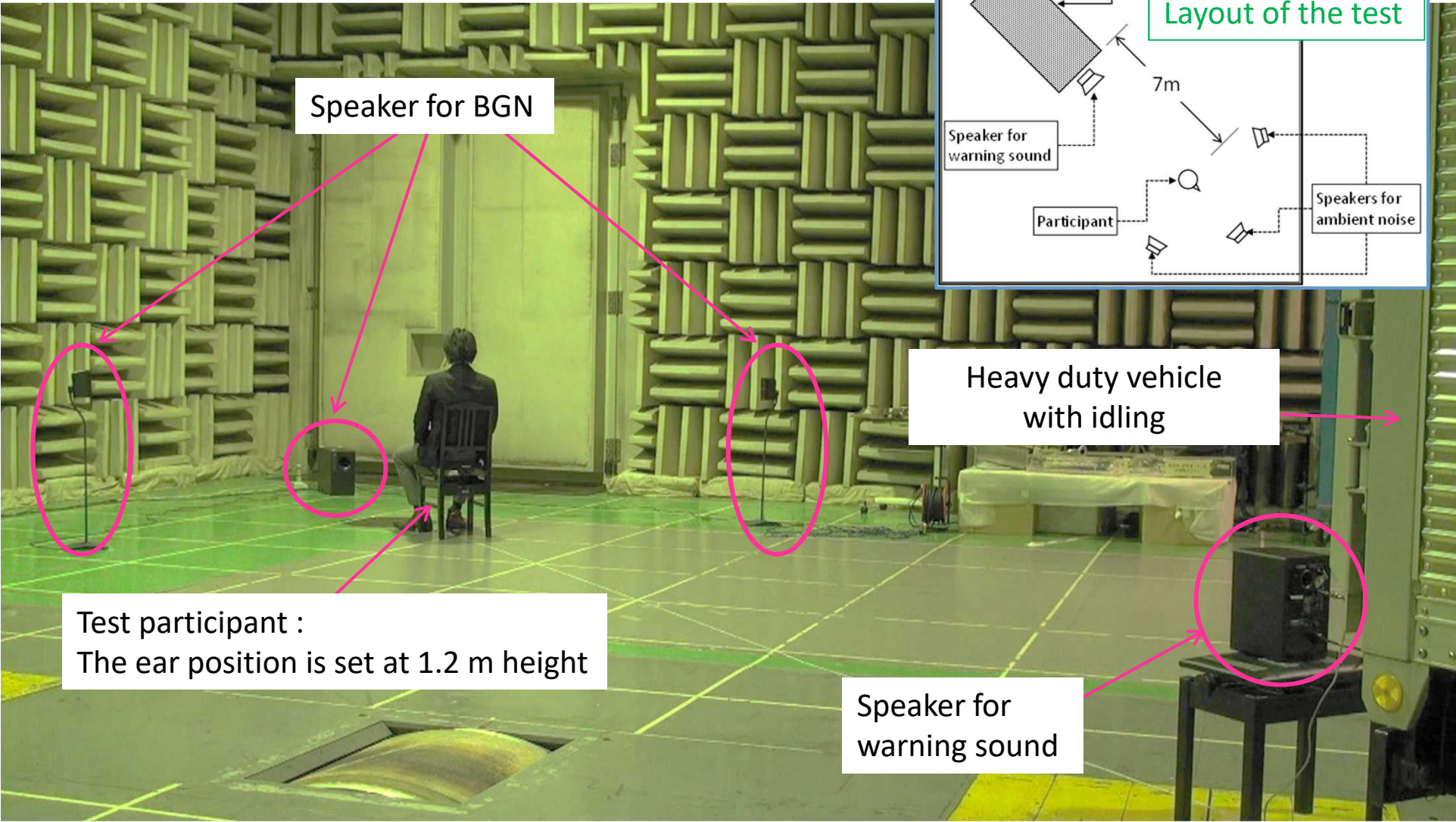   (All values are L_{Aeq}.)

High	BGN level of "High level" : 65dB -
Normal	BGN level of "Normal level": 40 - 65 dB
Low	BGN level of "Low level" : - 40 dB

   The expected use of the "Low level" is about 40dB

Measurement results of road transportation area (Outside)

Category of area		Time	Number of measurement	Averaged L_{Aeq} （dB)	Standard deviation
Detached housing area	Urban	Day	108	44	2.9
		Night	25	38	3.4
	Suburban	Day	41	43	2.8
		Night	25	38	3.1
	Local city	Day	24	45	3.9
		Night	9	39	2.8
	Rural	Day	11	43	3.6
		Night	5	38	2.0
High-rise housing area	Urban	Day	40	49	2.5
		Night	18	43	3.6
	Suburban	Day	17	45	2.4
		Night	5	42	2.8
Commercial area		Day	2	62	—
Industrial establishment area		Day	14	63	10.0
Local shopping area		Day	38	66	3.7
Busty shopping street		Day	13	71	4.8
Restaurant district		Night	11	66	3.2

S. Sueoka., et. al, "An Investigation of the New Index of the Noise Level in Japan (in Japanese)," Journal of Environmental Laboratories Association, Vol.34, no.22, 22, 2009

Evaluation test

Layout of the test

Truck (3t)

Speaker for warning sound

7m

Participant

Speakers for ambient noise

Speaker for BGN

Heavy duty vehicle with idling

Test participant :
The ear position is set at 1.2 m height
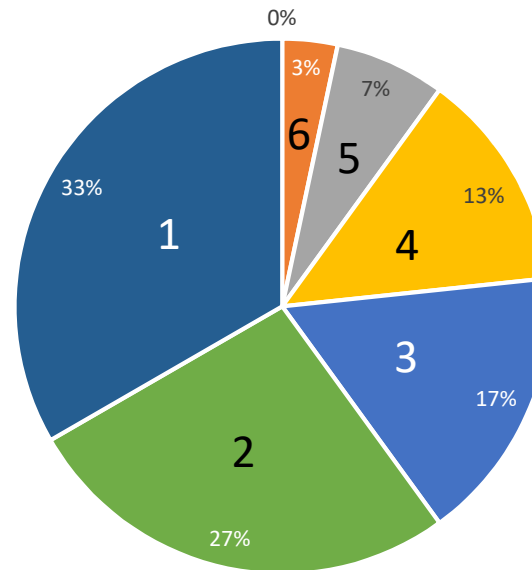
Speaker for warning sound

3

Impression of warning sound

After the test, the participants answered about their impressions of "Tonal sound" and "Broad band sound".
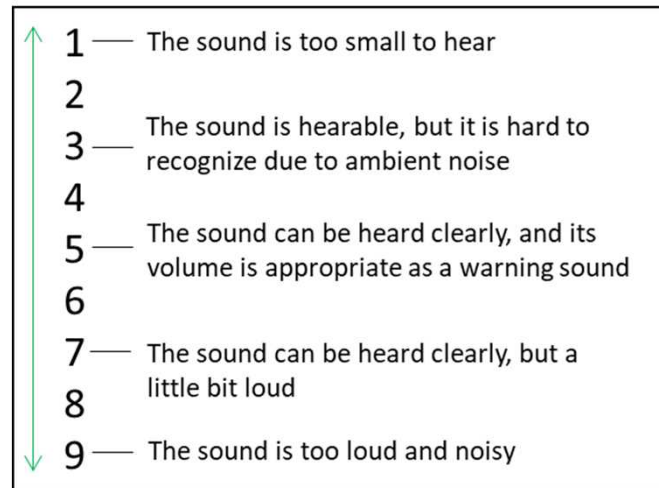

7	↑ Appropriate
6	
5	
4	
3	
2	
1	↓ Inappropriate
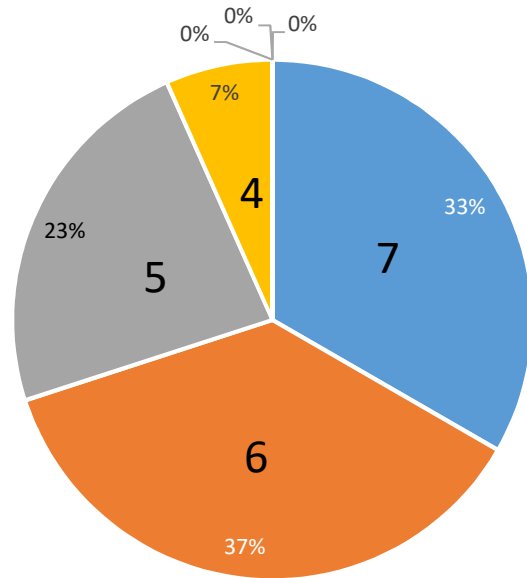
Tonal sound   Broad band sound
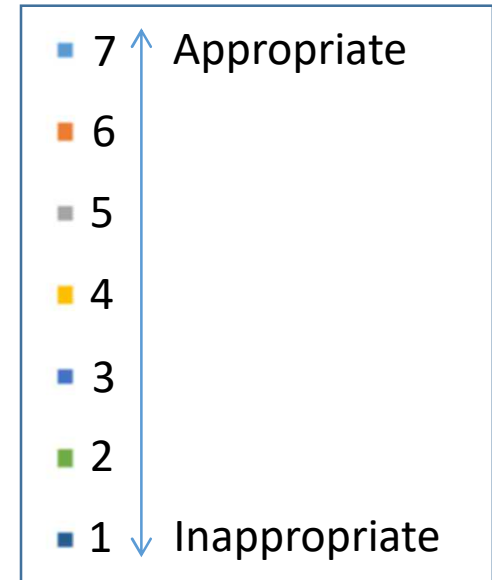
- Almost all of the participants answered TS is appropriate as a warning sound.
  Most of the participants understood what the TS is, and if it can be heard, it will work as a warning sound.
- The scores of BBS for this question is not positive because BBS is not widely used in Japan. It isn't recognized as a warning sound.

4

Evaluation score

Subjects were asked to rate their impressions of the reverse warning sound on a scale of 1 to 9.
The evaluation score was created by combining acceptability and detectability.
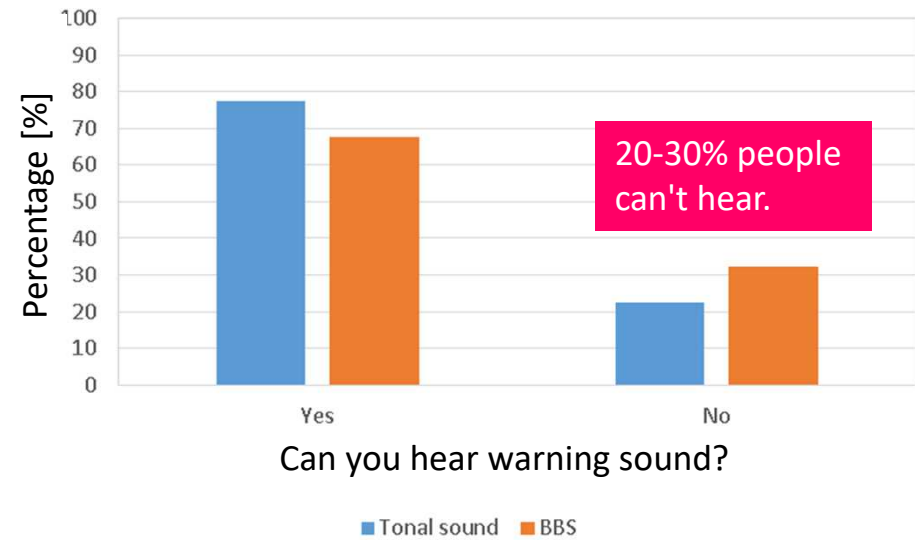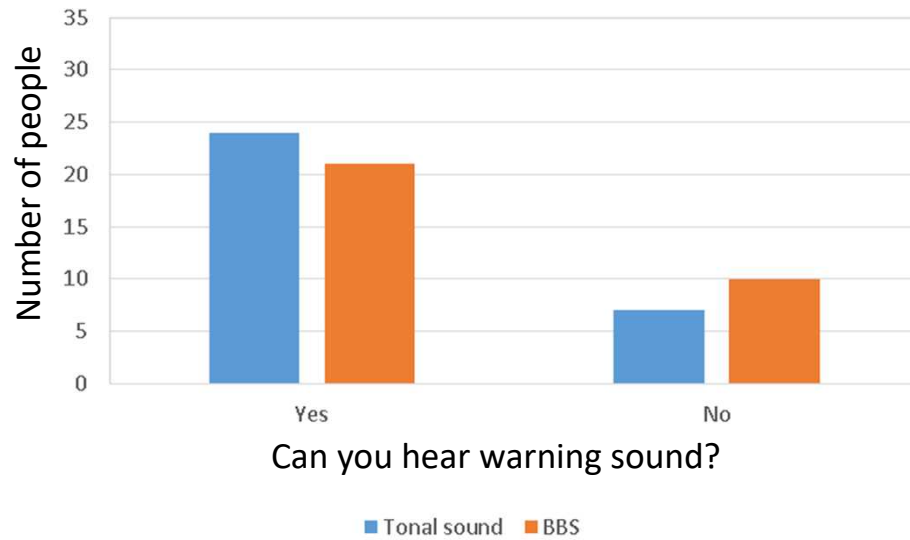

Here, the data were tabulated with a score other than inaudible, where 2 or more was heard and 2 or less was not heard.
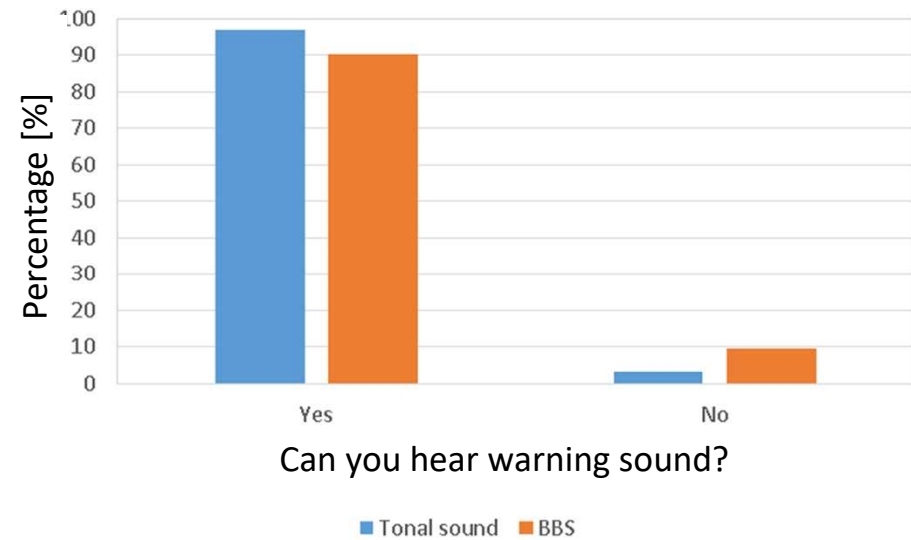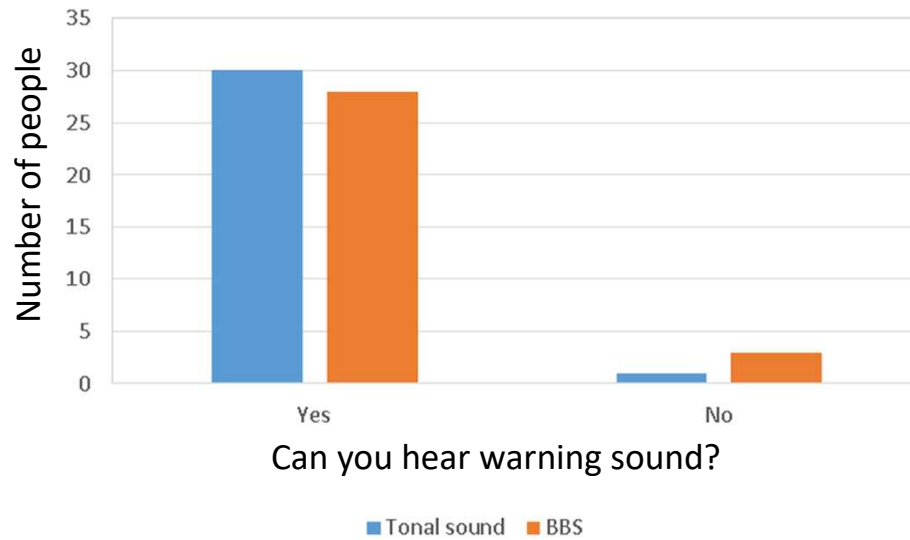
Warning sound level = 40dB

BGN：45dB & Engine idling -> BGN level at test participant's ear position = 50dB
SPL of warning sound is 10dB lower than BGN level.


6

Warning sound level = 50dB

BGN：45dB & Engine idling -> BGN level at test participant's ear position = 50dB
SPL of warning sound is equal to BGN level.

Despite the warning sound is equal to BGN level, more than 90% people can hear.

Warning sound level = 45dB (Calculated from results of "40dB" and "50dB")

BGN：45dB & Engine idling -> BGN level at test participant's ear position = 50dB
SPL of warning sound is 5dB lower than BGN level.

More than 90% people can hear TS.
More than 80% people can hear BBS.
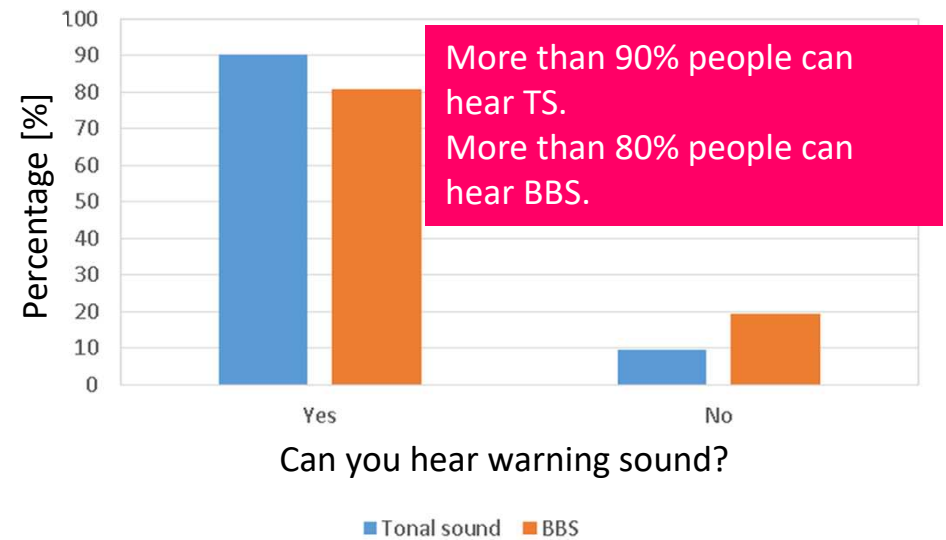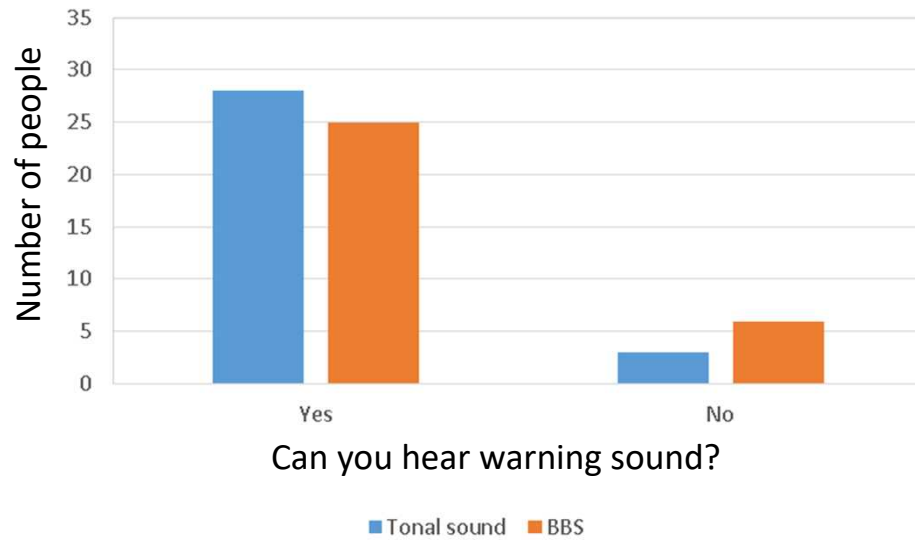
Summary

Most of the test participants answered that "Tonal sound" is appropriate as a warning sound, and it is widely recognized in Japan, so it is considered to play a role as a warning sound if it can be heard.

Warning sound level : 40dB,　BGN level : 50dB
- 20-30% participants can't hear warning sound with engine idling.

Warning sound level : 50dB,　BGN level : 50dB
- More than 90% participants can hear warning sound with engine idling.

Warning sound level : 45dB ,　BGN level : 50dB
（Calculated from the results of "40dB" and "50dB"）
- More than 90% participants can hear warning sound with engine idling.

Considering "Low level" usage situation (L_{Aeq} < 40dB), 40 dB waring sound will be detectable because its SPL is much higher than BGN level in the high frequency range. Therefore, it is appropriate as lower limit of "Low level".