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Accessible design — Auditory guiding signals in public facilities

Produits assistive pour des personnes avec l'incapacité — Conception accessible — Signaux de guidage auditifs dans les équipements publics

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Foreword

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The committee responsible for this document is ISO/TC 173, *Assistive products for persons with disability*, Subcommittee SC 7, *Accessible design*.

Introduction

When the persons with seeing impairment and blindness walk and travel independently, the auditory guiding signals in public facilities for mobility assistance are very beneficial for them to know the location (i.e. direction and distance).

This International Standard provides the guidelines of sound characteristics and specifications of sound equipment of the auditory guiding signals in public facilities for mobility assistance of mainly the persons with seeing impairment and blindness. The provided sound characteristics and specifications of sound equipment enable the user to detect the sound location correctly even in the noisy environment.

This International Standard is useful for the sound designers who design the auditory guiding signals in public facilities, and the designers who plan the public facilities.

Accessible design — Auditory guiding signals in public facilities

1 Scope

This International Standard specifies the sound characteristics of auditory guiding signals for persons with seeing impairment and blindness to provide the location and direction information of particular public facilities. The public facilities include facilities such as railway stations, airports, ports, bus terminals, government offices, libraries, community centres, parks, schools, hospitals, theatres, large supermarkets, and its toilets, stairs, etc.

EXAMPLE As an auditory guiding signal, a chime sound is emitted from the ticket gate of a railway station. Pedestrians, including persons with seeing impairment and blindness, are able to know the location of the ticket gate by detecting the location of the chime sound.

NOTE 1 The auditory guiding signals are also helpful for sighted persons.

This International Standard also specifies the design or usage of the equipment that provides auditory guiding signals.

This International Standard does not specify the characteristics of the alerts, such as alarm sounds or emergency signals.

NOTE 2 The auditory danger signals are covered by ISO 7731.

This International Standard does not specify the characteristics of auditory guiding signals coming from the personal mobile equipment that is worn by persons with seeing impairment and blindness.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
auditory guiding signal
sound signal that provides the location and direction information of particular public facilities

2.2
harmonic tone
sound that consists of the fundamental frequency component and its multiple frequency components

EXAMPLE Sounds that have a periodical waveform such as musical tone, triangle wave sound, rectangle wave sound, and saw-teeth wave sound.

2.3
sound signal generator
equipment that generates the electric analogue signal to be provided to the loudspeaker

2.4
goal
point that *auditory guiding signal* (2.1) intends to guide

EXAMPLE Entrance of the facility, ticket gate of the railway station, restroom, beginning point of stairs, etc.

2.5
emission angle
angle in where sound attenuation is less than 10 dB from that of emission axis

3 Requirements and recommendations

3.1 Sound characteristics

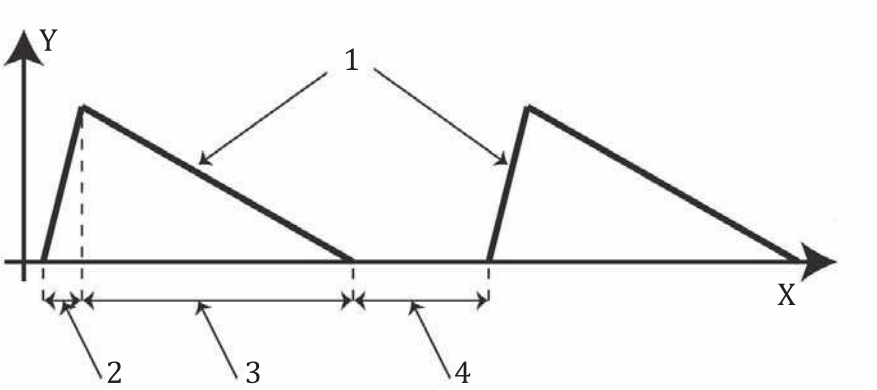
3.1.1 Envelope

The duration of attack part of auditory guiding signals shall be longer than 0 ms and shall not be longer than 5 ms.

NOTE 1 The attack part that is not longer than 5 ms enables the listener to detect the direction of sound easily.

NOTE 2 The decay part does not have an influence upon the sound localization.

The interval between auditory guiding signals should be no longer than 2 s.



Key

1 signal
2 attack
3 decay
4 interval
X time
Y amplitude

Figure 1 — Envelope of signal

3.1.2 Frequency component

The lowest frequency component shall not be higher than 1 kHz.

NOTE 1 If the sound is harmonic tone, the lowest frequency is equal to the fundamental frequency.

The highest frequency component shall not be lower than 8 kHz.

NOTE 2 The highest frequency component that is not lower than 8 kHz enables listener to detect the direction of sound easily.

If the sound is harmonic tone, it should have all order of harmonics in its frequency band.

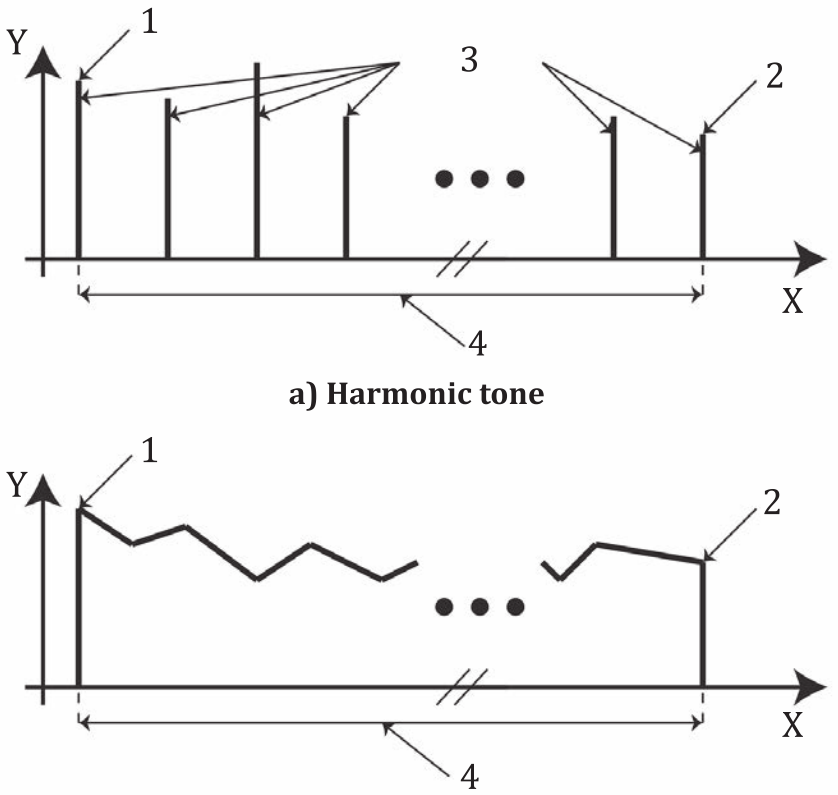
The sound that has only one frequency component shall not be used as auditory guiding signals.

NOTE 3 If the sound has narrow or poor frequency components, it does not satisfy the requirements.

EXAMPLE 1 A sow-teeth wave sound has all harmonics in its frequency band.

If the sound is not harmonic tone, it should have frequency components as many as possible in its frequency band, and it should have the spectrum that the user can distinguish it from ambient noise.

EXAMPLE 2 The non-harmonic sound for auditory guiding signals include combination of harmonic tones, impulse sound, etc.



a) Harmonic tone

b) Non-harmonic tone

Key

1 lowest frequency component
2 highest frequency component
3 harmonics
4 frequency band width
X frequency
Y power

Figure 2 — Frequency components

3.2 Equipment

3.2.1 Sound signal generator

The sound signal generator shall be able to generate the auditory guiding signal that have the frequency component provided in 3.1.2.

If the auditory guiding signal is recorded, reproduced, and/or transferred digitally, the sampling resolution shall not be less than eight bits, and should not be less than 16 bits.

If the auditory guiding signal is recorded as compressed data, the compression ratio should not be so high as to degrade sound quality.

3.2.2 Loudspeaker

The loudspeaker shall be able to emit the auditory guiding signal that have the frequency component provided in 3.1.2.

EXAMPLE The general full-range loudspeaker that has about 10 cm diameter and is installed in an appropriate box has nearly flat frequency characteristics in the rage of 100 Hz to 10 kHz.

3.2.3 Arrangement of loudspeakers

The loudspeaker and the goal should be located on the same vertical line, with the loudspeaker facing the main stream of pedestrians.

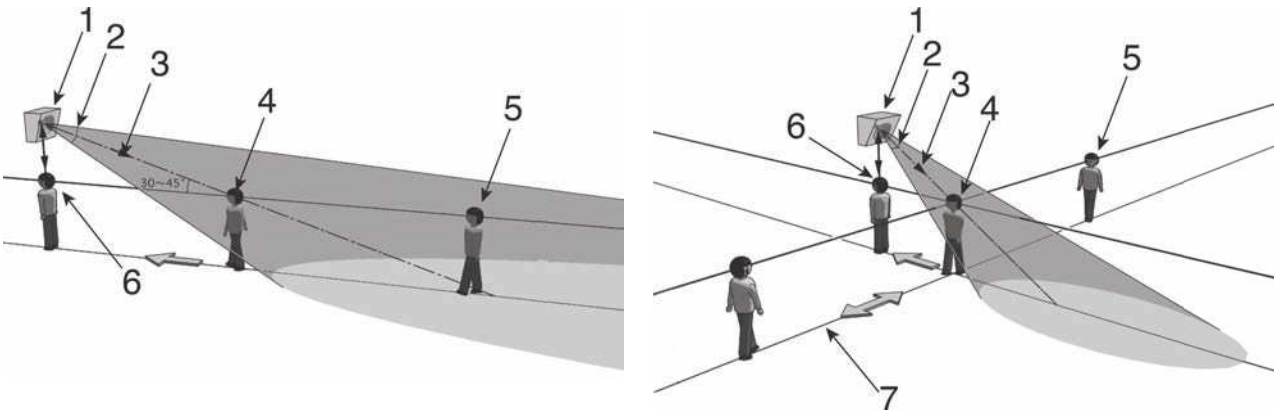
EXAMPLE 1 The loudspeaker faces the crossing point of the main stream of pedestrians and the path to the goal.

EXAMPLE 2 The loudspeaker is suspended from the ceiling and is located above the goal at 3 m height from the floor.

EXAMPLE 3 The loudspeaker is installed in the short vertical pole on the floor and is located on the goal at 0,8 m height from the floor.

The obstacles that disturb the sound propagation shall not be on the emission axis of the loudspeaker, and should not be in the range within 3 m in the emission angle of the loudspeaker.

EXAMPLE 4 The obstacles that disturb the sound propagation include signboards, walls, poles, etc.



a) Identical **b) Not identical**

Key

1 loudspeaker
2 emission angle
3 emission axis
4 listening point
5 user
6 goal
7 main stream of users

Figure 3 — Arrangement of loudspeaker in the cases that main stream of users and course of goal is identical (a) and not identical (b)

3.3 Ambient sound environment

3.3.1 Signal-to-noise ratio

The signal-to-noise ratio shall not be less than 10 dB at the listening point.

In order to measure the signal-to-noise ratio, sound pressure level of signal and sound pressure level of ambient noise shall be measured.

Maximum sound pressure level with a standard frequency weighting “A” and a standard exponential time weighting “FAST (F)” shall be used for signal.

Time-average sound pressure level with a standard frequency weighting “A” should be used for ambient noise.

3.3.2 Auditory guiding signals for different goals

If the auditory guiding signals for different goals can be heard at one place, they should not sound each other simultaneously to avoid overlap.

3.3.3 Sound reflection and reverberation

The sound reflection and reverberation should be reduced as much as possible.

NOTE 1 If the sound reflection and/or reverberation disturb the listening of auditory guiding signals, the sound absorbents can be put on the ceiling and/or wall.

NOTE 2 It is desirable to design the space by taking the ambient sound environment into consideration.

3.3.4 Operation of auditory guiding signals

The auditory guiding signals shall work constantly.

NOTE If there is the specific time range when no user is in the public facilities, the auditory guiding signals can be controlled.

The loudspeaker and/or its container should have the appearance that indicates that it is the equipment of the auditory guiding signals for mobility assist.

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