PUBLICLY AVAILABLE SPECIFICATION

ISO/PAS 11819-4

First edition
2013-03-15

Acoustics — Method for measuring the influence of road surfaces on traffic noise —

Part 4: SPB method using backing board

Acoustique — Méthode de mesurage de l'influence des revêtements de chaussées sur le bruit émis par la circulation —

Partie 4: Méthode SPB avec utilisation de panneau

Reference number
ISO/PAS 11819-4:2013(E)

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Published in Switzerland

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Foreword

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Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/PAS 11819-4 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

ISO/PAS 11819 consists of the following parts, under the general title *Acoustics — Measurement of the influence of road surfaces on traffic noise*:

— *Part 1: Statistical pass-by (SPB) method*

— *Part 2: Close-proximity (CPX) method*

— *Part 3: Reference tyres* [Technical Specification]

— *Part 4: SPB method using backing board* [Publicly Available Specification]

Introduction

ISO 11819-1 specifies a method for measuring the acoustic quality of roads called the statistical pass-by (SPB) method. Owing to severe requirements on the acoustical environment at the measurement site, the method cannot generally be used at any arbitrary location.

This part of ISO 11819 complements ISO 11819-1 for applications in situations where the test conditions cannot be met — such as when there may be a potential influence of acoustic reflections from the rear of the measurement position. However, it must be recognized that there will be a reduction in the accuracy of the results in comparison to a true free-field measurement.

Acoustics — Method for measuring the influence of road surfaces on traffic noise —

Part 4:
SPB method using backing board

1 Scope

This part of ISO 11819 specifies a modified version of the statistical pass-by (SPB) method given in ISO 11819-1 that uses a microphone mounted on a backing board instead of a microphone in normal, free-field conditions. It is applicable to measurements taken in an urban, built-up, environment or in the presence of safety barriers, noise barriers, embankments or road cuttings.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11819-1, *Acoustics — Measurement of the influence of road surfaces on traffic noise — Part 1: Statistical pass-by (SPB) method*

ISO 1996-2, *Acoustics — Description, measurement and assessment of environmental noise — Part 2: Determination of environmental noise levels*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11819-1 and the following apply.

3.1
backing board
rectangular, hard, reflective board on which a microphone is mounted

3.2
conventional microphone
free-field or pressure microphone

3.3
surface microphone
flush-mounted microphone designed to measure sound pressure on a surface without requiring the drilling of a hole through it

4 Measurement principle

The principle is the same as for ISO 11819-1, except that the microphone is mounted on a backing board rather than being used in normal free-field conditions.

By mounting the microphone membrane very close to the backing board during measurements, noise from behind (for example, reflections from facades or noise barriers) is suppressed. The noise coming from the front is reflected by the backing board in a controlled way so that it can be taken into account by applying a correction to the measured value. In principle, the A-weighted sound pressure level increases by 6 dB due to a doubling of the sound pressure caused by the backing board.

5 Apparatus

5.1 General

The same measuring instruments as for the SPB method shall be used.

Alternatively, a surface microphone may be used.

5.2 Backing board

5.2.1 Dimensions

The backing board shall have a rectangular shape.

The width shall be 900 mm ± 10 mm and the height 750 mm ± 10 mm (see Figure 1).

5.2.2 Position

The backing board shall be oriented parallel to the road and 7,50 m ± 0,10 m from the centre of the road lane that is the subject of the measurement.

5.2.3 Material

The board shall be acoustically hard and at least 15 mm thick to avoid vibration.[1]

If metal is used, the properties shall satisfy ISO 1996-2.

The mass of the board shall be at least 14 kg/m^2 (Reference[2]).

NOTE 1 In tests made prior to publication of this part of ISO 11819, medium-density fibre board was used and worked well.

NOTE 2 More information about material properties is available in ISO 1996-2.

5.3 Microphone

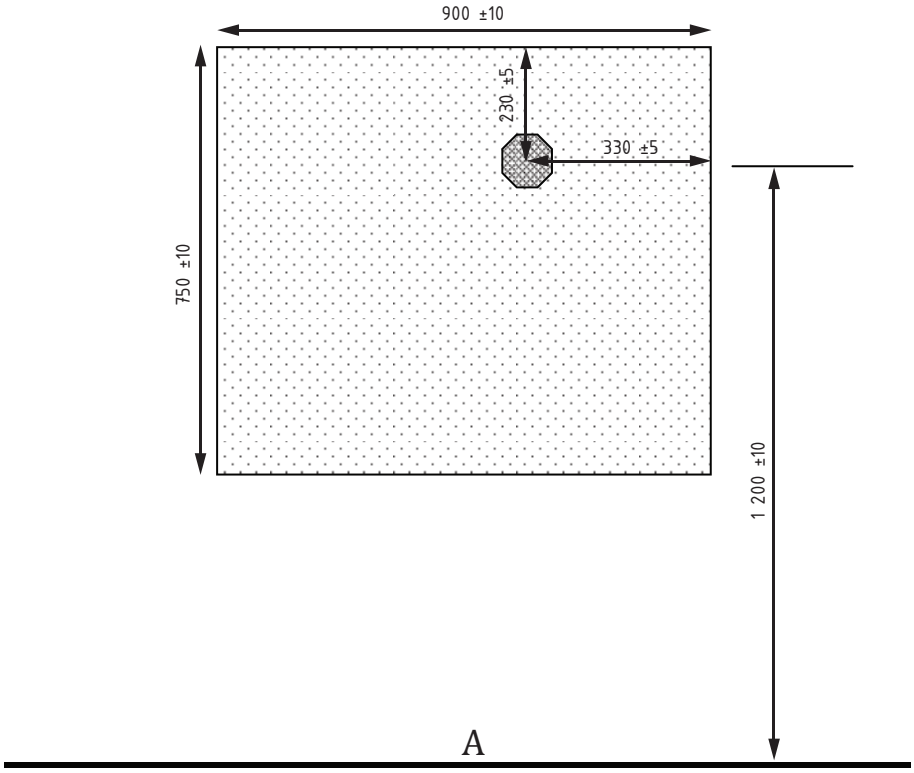
5.3.1 Position

The microphone shall be located in the same position relative to the road as for the SPB method according to ISO 11819-1. To achieve this, the position of the backing board is set with respect to the microphone.

In order to minimize the effect of diffraction with constructive interference at the edges, position the microphone away from the centre of the board and from the board's diagonals and centrelines. Mount the microphone in the upper right-hand corner of the board, 330 mm ± 5 mm from the right-hand edge and 230 mm ± 5 mm from the upper edge (see Figure 1).[4]

Microphones having a diameter greater than 12,7 mm (1/2 inch) shall not be used.

Dimensions in millimetres



Key

A road reference level according to ISO 11819-1

Figure 1 — Backing-board dimensions and microphone position as seen from sound source (independent of traffic direction)

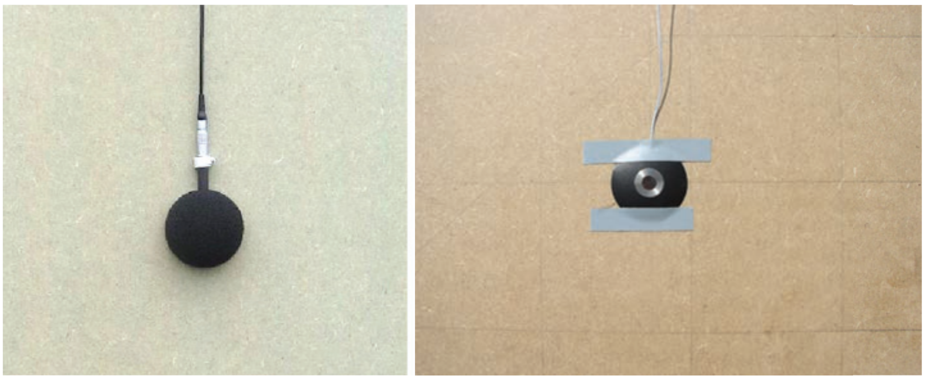
5.3.2 Mountings

The following microphone mountings are permitted:

— the microphone mounted as close as practicable to the board, with the casing touching the board if feasible (microphone casing parallel to the board),

— a surface microphone mounted flush with the surface of the board.

Figure 2 shows a close-up view of the mounting.



Left free-field microphone

Right surface microphone

Figure 2 — Examples of microphone mountings[2][4]

A third option is to mount the microphone through a hole in the board, with the membrane flush with the board surface (see ISO 1996-2). This might be a little less practical than the other options, but gives an equivalent result.

5.3.3 Effect of microphone type

For the frequency range considered, it is acceptable to use either a free-field or pressure microphone.

The choice of either a free-field or surface microphone can have a marginal effect on the measured levels. In general, the surface microphone has the lower effect, but the differences are just a few tenths of a decibel, so no correction for microphone type is required.

5.3.4 Microphone protection

The free-field microphone, if chosen, shall be protected from the influence of wind, etc., by a suitably shaped windscreen mounted around it.

A windscreen is not required for a surface microphone.

6 Test sites

6.1 Selection of measuring site

The measuring-site selection criteria shall be those of the SPB method according to ISO 11819-1, except for criteria related to reflections from behind (see below).

6.2 Paired- and single-site measurements

Measurements shall be in accordance with ISO 11819-1.

6.3 Deviations from free-field conditions

The provisions relating to acoustic reflections from objects in front of the microphone given in ISO 11819-1 apply; for reflections from behind the microphone and the backing board, there are no restrictions.

6.4 Guard rails and other barriers that can reflect or screen sound

The criteria for taking into consideration guard rails or other barriers that can reflect or screen sound shall be the same as those of the SPB method according to ISO 11819-1, except in respect of objects and reflections from behind, for which there are no restrictions.

Any large object located behind the backing board (within 25 m) shall be noted in the test report, together with an estimation of its distance from the board.

NOTE If there is a large object such as a building façade or bus located close behind the backing board, there could be a small increase in noise levels. Increases of up to 0,5 dB have been measured for such objects located 0,6 m behind the backing board.[1] The amount of influence due to reflected sound depends on the frequency content of the vehicle noise source and the dimensions and proximity of the reflecting object.

6.5 Surface between tested road surface and microphone

This surface shall be in accordance with ISO 11819-1.

6.6 Special site conditions

Any special site conditions shall be in accordance with ISO 11819-1.

7 Traffic conditions

The traffic conditions shall be in accordance with ISO 11819-1.

8 Measuring procedure

The measuring procedure shall be in accordance with ISO 11819-1.

9 Normalization of data

9.1 Regression analysis

The regression analysis shall be in accordance with ISO 11819-1.

9.2 Determination of vehicle sound level at reference speeds

This determination shall be in accordance with ISO 11819-1.

9.3 Useful speed range for regression line

Speed shall be in accordance with ISO 11819-1.

NOTE The backing board version of the SPB method has been validated only for reference speeds above 45 km/h.[1] However, there is no obvious reason why it should not work well below this speed.

9.4 Correction of sound levels for temperature

This correction shall be in accordance with ISO 11819-1.

9.5 Correction for the influence of the backing board

9.5.1 Speed and vehicle category

In order for the reported levels of noise to be equivalent to those measured in free-field conditions, the correction values of the corresponding speed category in Table 1 shall be subtracted from the calculated vehicle sound levels for the different vehicle categories.

Table 1 — Correction values for different road speed and vehicle categories[5]

Vehicle category		Road speed category		
Name	No.	Low	Medium	High
Cars	1	6,0 dB	6,0 dB	6,0 dB
Dual-axle heavy vehicles	2a	6,0 dB	6,0 dB	6,0 dB
Multi-axle heavy vehicles	2b	6,0 dB	6,0 dB	6,0 dB
NOTE These corrected vehicle sound levels are used to determine the statistical pass-by index (SPBI) (see 9.6).				

9.5.2 Frequency spectra

The backing board version of the SPB method should be used[1]

— only for road traffic noise having a fairly typical broadband spectrum and a peak at around 1 000 Hz,

— mainly for determining overall A-weighted sound pressure levels.

Frequency spectra determined using the backing board version of the SPB method should be considered with great care. Nevertheless, it is recommended that frequency spectra corrected with the values in Table 1 be reported for possible future reference.

NOTE Studies have indicated that one-third-octave-band levels in bands below 500 Hz and above 2 000 Hz may not be properly corrected using the values given in Table 1.[1]

9.6 Determination of statistical pass-by index (SPBI)

The SPBI shall be determined in accordance with ISO 11819-1, but with the vehicle sound levels corrected using Table 1.

9.7 Measurement uncertainty

The measurement uncertainty is according to ISO 11819-1 plus an additional uncertainty related to the correction factors in Table 1 of approximately 0,5 dB, expressed as a standard uncertainty. This additional uncertainty should be added linearly.[5]

For one-third-octave-band levels, the uncertainty is unknown (refer to the note in 9.5.2).

10 Reference road surface

The reference road surface shall be in accordance with ISO 11819-1.

11 Meteorological conditions

The meteorological conditions shall be in accordance with ISO 11819-1.

12 Background noise

The background noise shall be in accordance with ISO 11819-1.

13 Reported data

The same data as for the SPB method according to ISO 11819-1 shall be reported, supplemented by the following:

— dimensions, weight, material of the backing board;

— type of microphone, mounting method, windscreen and microphone position on the board;

— details of objects behind the backing board in accordance with 6.4;

— vehicle sound levels and SPBI corrected for the backing board.

Annex A
(informative)

Backing board position in narrow roads or streets

A.1 General

When the road or street does not allow the backing board to be placed as far as 7,50 m from the middle of the tested lane, a closer position may be used. This could be necessary when there are buildings, solid barriers or other walls very close to the road or street on one side. However, every reasonable effort shall first be made to attain the 7,50 m distance.

A.2 Positions of backing board and microphone

The backing board may be placed 5,00 m ± 0,10 m from the middle of the lane being tested. The microphone shall then be placed at a height of 0,80 m ± 0,10 m above the road level (see Figure 1).

NOTE The lower height is intended to give an angle of incidence of sound waves from sources near the road surface similar to that given by the normal backing board and microphone positions.

A.3 Correction for influence of backing board

In addition to the correction specified in 9.5, a correction of 3,5 dB shall be used to correct for the difference in distance (5,00 m versus 7,50 m). As in the case of the corrections of 9.5, this additional correction shall be subtracted from the calculated vehicle sound levels.

NOTE The value of 3,5 dB is derived from the "acoustical distance law" and has been verified in practice to be approximately valid for cars as well. For multi-axle heavy vehicles, the validity is lower.

A.4 Measurement uncertainty

When this shorter distance is used, the estimated additional uncertainty of the vehicle sound levels specified in 9.7 shall be replaced by values of 0,7 dB for cars and 1,0 dB for heavy vehicles.

For frequency spectra, the uncertainty is even higher. Consequently, frequency spectra measured this close to the road are too uncertain to be recommended.

A.5 Reported data

In addition to the reported data according to Clause 13, it shall be clearly noted that the backing board was placed at 5,00 m from the middle of the tested lane instead of the normal 7,50 m.

Reference shall be made to Annex A and to the concerns expressed in this annex regarding the results.

Bibliography

[1] Haider M. Noise classification methods for urban road surfaces: Backing Board Method. FP6 Project Silence, 2007

[2] Bergiers A. Final Report Round Robin Test SPB Measurements, Belgian Road Research Centre. BRRC, Belgium. 2010. http://www.brrc.be/pdf/15/BRRC_SPB_Report.pdf

[3] Fegeant O. On the Use of a Vertical Microphone Board to Improve Low Signal-to-Noise Ratios During Outdoor Measurements. *Appl. Acoust.* 1997, **53** (4) pp. 201–312

[4] Haider M., Conter M. Austrian experience with the backing board method for statistical pass-by measurements, Proc. of Acoustics 08, Paris, France, 29 June–4 July, 2008

[5] Bergiers A. Validation of the Statistical Pass By–Backing Board Method for Heavy Traffic. Proc. of ICSV18, Rio de Janeiro, Brazil. 2011

ICS 17.140.30

Price based on 9 pages