PD ISO/TR 17534-2:2014

BSI Standards Publication

# Acoustics — Software for the calculation of sound outdoors

## Part 2: General recommendations for test cases and quality assurance interface

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## National foreword

This Published Document is the UK implementation of ISO/TR 17534-2:2014.

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PD ISO/TR 17534-2:2014

# TECHNICAL REPORT

# ISO/TR 17534-2

First edition
2014-08-01

## Acoustics — Software for the calculation of sound outdoors —

## Part 2:
## General recommendations for test cases and quality assurance interface

*Acoustique — Logiciels pour le calcul des bruits à l'air libre —*

*Partie 2: Recommandations générales pour les cas d'essai et l'interface d'assurance qualité*

Reference number
ISO/TR 17534-2:2014(E)

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# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

ISO 17534 consists of the following parts, under the general title *Acoustics — Software for the calculation of sound outdoors*:

— *Part 1: Quality requirements and quality assurance*

— *Part 2: General recommendations for test cases and quality assurance interface* [Technical report]

The following parts are under preparation:

— *Part 3: Recommendations for quality assured implementation of* ISO 9613-2 *in software according to* ISO 17534-1 [Technical report]

# Introduction

The general structure of the ISO 17534 series consisting of ISO 17534-1 and various Technical Reports is shown in Figure 1. The series itself describes the measures necessary to assure a high quality calculation methods implemented in different software products with respect to correctness and precision. The requirements and specifications included are obviously independent from a specific calculation method, because they should be applied for all of them.

This Technical Report contains generally applicable recommendations to be taken into account in the formulation of such recommendations in the method-specific Technical Reports. Further, a set of test cases is presented that can be supplemented with method-specific parameters to be applied in these Technical Reports.

This Technical Report is a first step. Contents will be supplemented step by step, and or even withdrawn due to newer technical or scientific expertise.

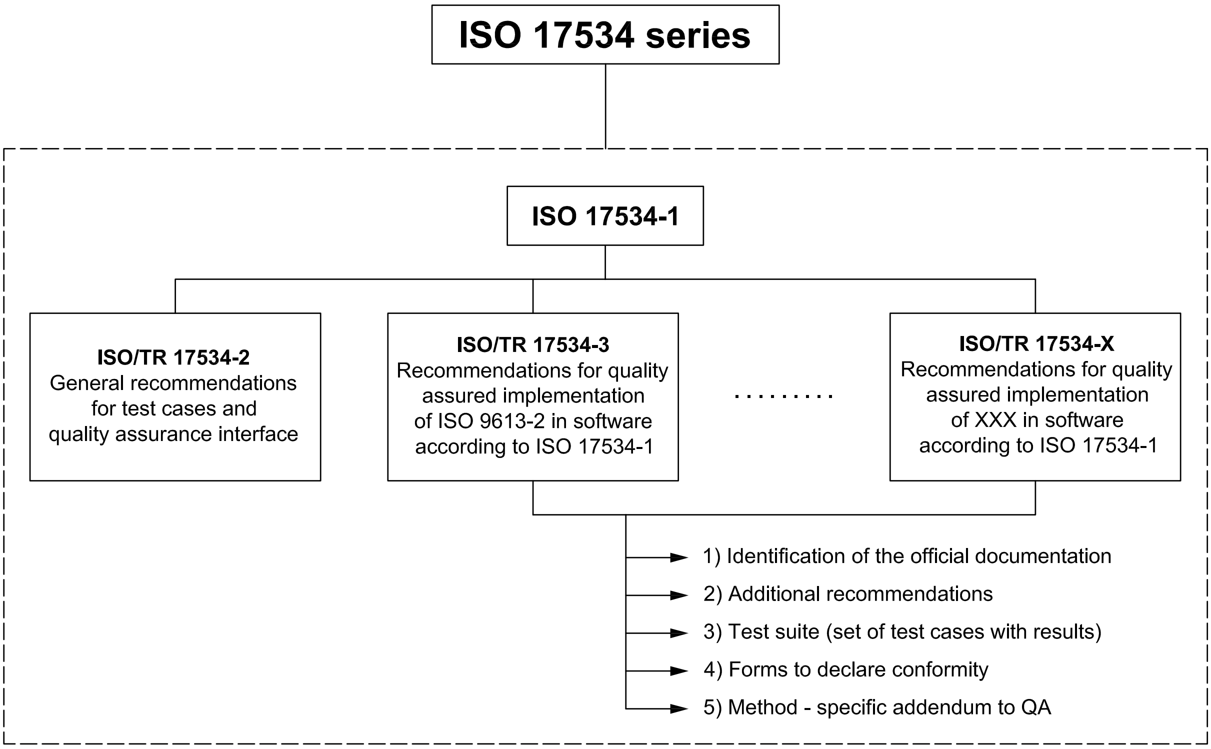



**Figure 1 — Structure of the ISO 17534 series consisting of the main Part 1 and subordinated Technical Reports**

# Acoustics — Software for the calculation of sound outdoors —

# Part 2:
# General recommendations for test cases and quality assurance interface

## 1 Scope

This Technical Report contains general additional recommendations for the implementation of calculation methods in software, a general applicable set of test cases described geometrically, and a description of the QA (Quality Assurance Interface) that allows the exchange of data between software programs quality assured according to ISO 17534-1.

ISO 17534 series contains identification of the official documentation.

## 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 17534-1:—, *Acoustics — Software for the calculation of sound outdoors — Part 1: Quality requirements and quality assurance*[1)]

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17534-1:— apply.

## 4 Additional recommendations

This chapter is only a place holder, it shall be decided from time to time if due to experience with method specific recommendations. These shall be taken as a general recommendation and transferred to this Technical Report.

## 5 Test cases (T)

### 5.1 General

All aspects of a method shall be covered by test cases. It is to ensure that the test cases cover the main issues which can significantly affect results.

These test cases are described with exact geometry, but generally with respect to parameters that might be different with different calculation methods.

For the precisely defined test cases, according to A.2 in ISO 17534-1:—, these general parameter descriptions can be concretized and supplemented by step-by-step results.

1) To be published.

## 5.2 Test cases (T) applicable in method specific Technical Reports

### 5.2.1 T01 to T03 — Flat ground with homogenous acoustic properties


**Key**

S source

R receiver

**Figure 2 — Test case to check free sound propagation with different conditions**

**Input data:**

**Table 1 — Coordinates of source, S, and receiver, R**

| | *x*<br>in m | *y*<br>in m | *z*<br>in m |
|---|---|---|---|
| S | 10 | 10 | 1 |
| R | 200 | 50 | 4 |

**Table 2 — Octave band sound power levels (linear) of the source**

| Quantity | Unit | Values | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $f$ | Hz | 63 | 125 | 250 | 500 | 1 000 | 2 000 | 4 000 | 8 000 |
| $L_W$ | dB | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 |

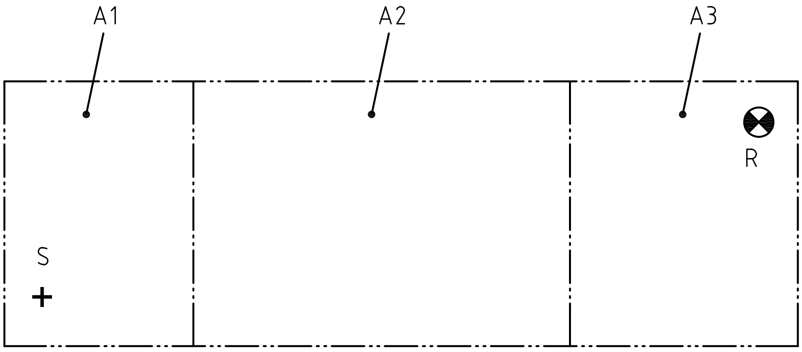
**T01 – Reflecting ground** (e.g. $G = 0$)

**T02 – Mixed ground** (e.g. $G = 0,5$)

**T03 – Porous ground** (e.g. $G = 1$)

### 5.2.2 T04 — Flat ground with spatially varying acoustic properties




**Key**

S source
R receiver
A1 reflecting ground
A2 mixed ground
A3 porous ground

**Figure 3 — Flat ground with spatially varying acoustic properties**

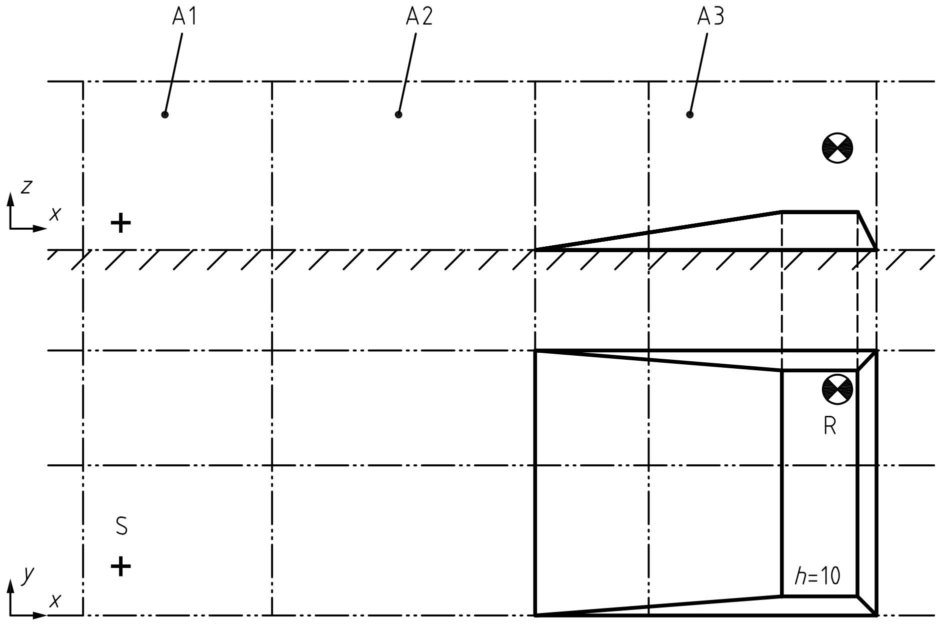
**Input data:**

Identical to above, but spatially varying acoustic properties as shown in Table 3.

**Table 3 — Areas with different acoustic properties (T04)**

| Area | Ground | Coordinates of areas | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $x_1$ in m | $y_1$ in m | $x_2$ in m | $y_2$ in m | $x_3$ in m | $y_3$ in m | $x_4$ in m | $y_4$ in m |
| A1 | reflecting | 0 | 60 | 50 | 60 | 50 | −10 | 0 | −10 |
| A2 | mixed | 50 | 60 | 150 | 60 | 150 | −10 | 50 | −10 |
| A3 | porous | 150 | 60 | 210 | 60 | 210 | −10 | 150 | −10 |

### 5.2.3 T05 — Ground with spatially varying heights and acoustic properties




**Key**

S source

R receiver

A1 porous ground

A2 mixed ground

A3 reflecting ground

**Figure 4 — Spatially varying heights and acoustic properties**

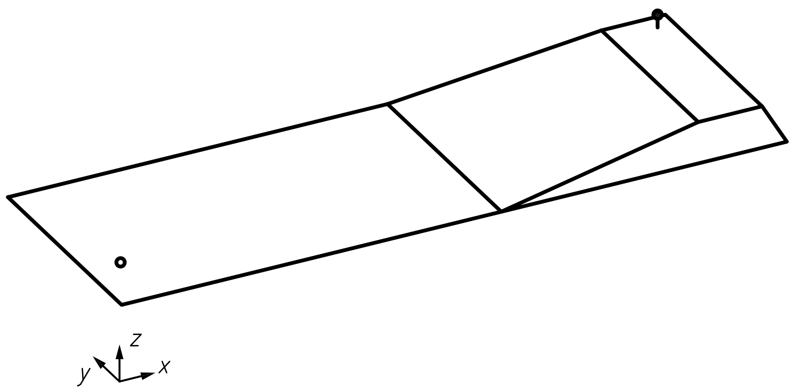



**Figure 5 — 3D presentation of scenario T05**

**Input data:**

For source and receiver positions and emission spectrum, see previous cases. Coordinates *z* for source and receiver are relative heights (height above ground).

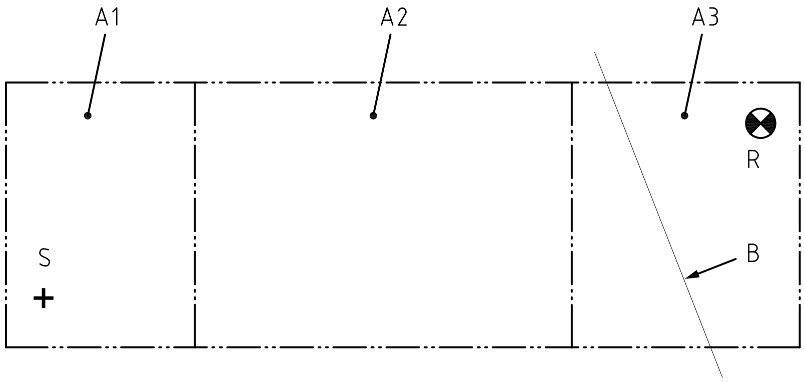
**Table 4 — Areas with different acoustic properties (T05)**

| Area | Ground | Coordinates of areas | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $x_1$ in m | $y_1$ in m | $x_2$ in m | $y_2$ in m | $x_3$ in m | $y_3$ in m | $x_4$ in m | $y_4$ in m |
| A1 | porous | 0 | 60 | 50 | 60 | 50 | −10 | 0 | −10 |
| A2 | mixed | 50 | 60 | 150 | 60 | 150 | −10 | 50 | −10 |
| A3 | reflecting | 150 | 60 | 210 | 60 | 210 | −10 | 150 | −10 |

**Table 5 — Contour lines (rectangular areas) (T05)**

| ***z*** in m | ***x*** in m | | ***y*** in m | |
|---|---|---|---|---|
| | min | max | min | max |
| 0 | 0 | 120 | −10 | 60 |
| 0 | 120 | 210 | −10 | 60 |
| 10 | 185 | 205 | −5 | 55 |

### 5.2.4 T06 — Flat ground with spatially varying acoustic properties and long barrier




**Key**

S source
R receiver
B barrier
A1 porous ground
A2 mixed ground
A3 reflecting ground

**Figure 6 — Areas with different acoustic properties and long barrier**

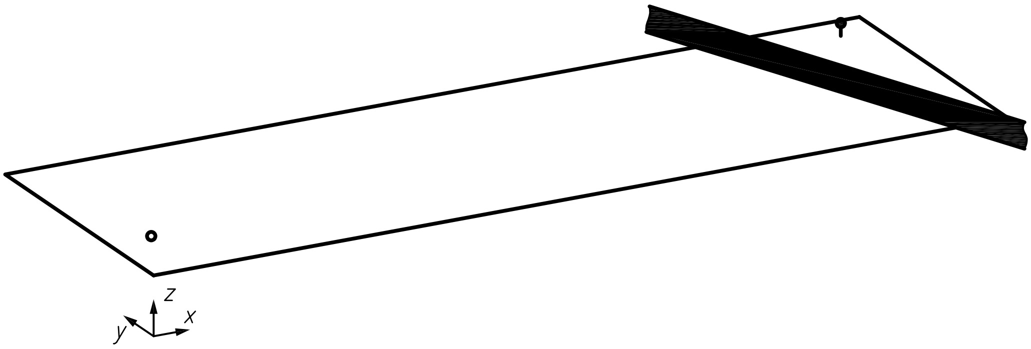



**Figure 7 — 3D presentation of scenario T06**

**Input data:**

Source and receiver coordinates – Table 1 (Test case T01)

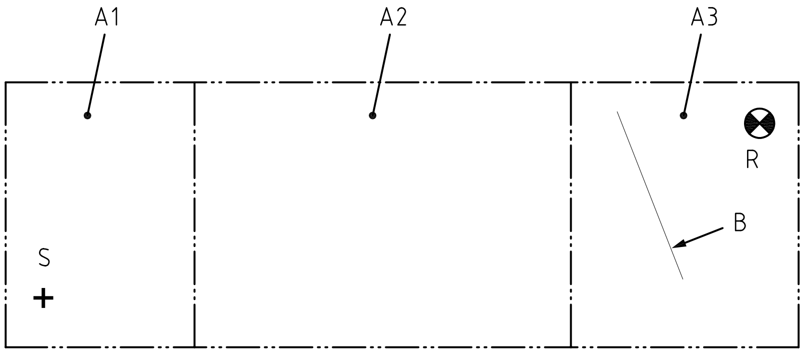
Source emission frequency spectrum – Table 2 (Test case T01)

Areas with different acoustic properties – Table 3 (Test case T04)

**Table 6 — Barrier geometry (T06)**

| Upper edge | *x* in m | *y* in m | *z* in m |
|---|---|---|---|
| S1 | 100,0 | 240,0 | 6,0 |
| S2 | 265,0 | –180,0 | 6,0 |

### 5.2.5 T07 — Flat ground with spatially varying acoustic properties and short barrier




**Key**

S source
R receiver
B barrier
A1 porous ground
A2 mixed ground
A3 reflecting ground

**Figure 8 — Areas with different acoustic properties and short barrier**

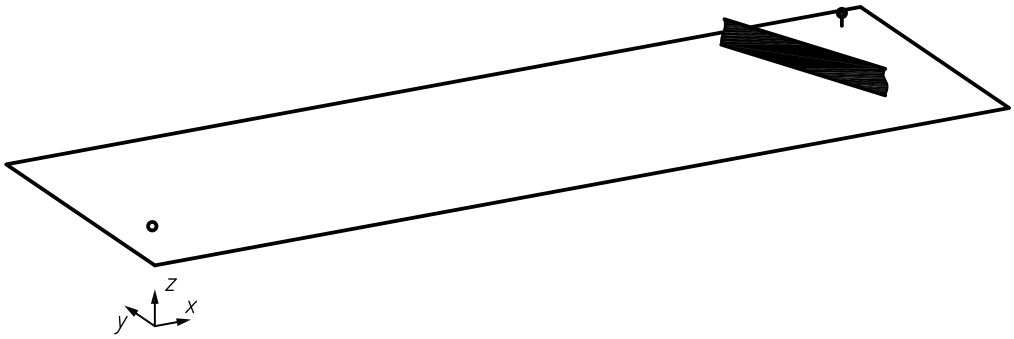



**Figure 9 — 3D presentation of scenario T07**

**Input data:**

Source and receiver coordinates – Table 1 (Test case T01)

Source emission frequency spectrum – Table 2 (Test case T01)

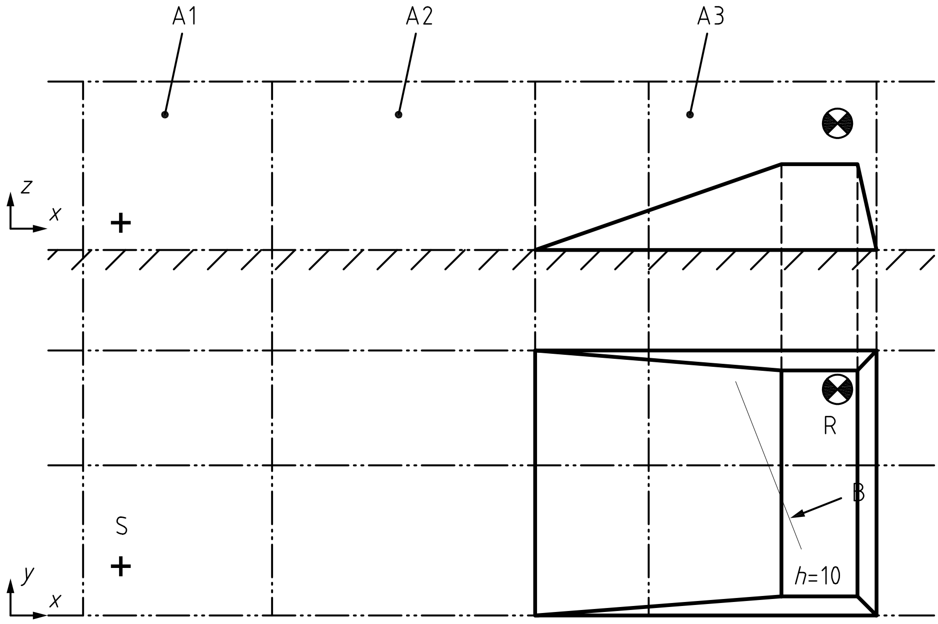
Areas with different acoustic properties – Table 3 (Test case T04)

**Table 7 — Barrier geometry (T07)**

| Upper edge | ***x*** in m | ***y*** in m | ***z*** in m |
|---|---|---|---|
| S1 | 175,0 | 50,0 | 6,0 |
| S2 | 190,0 | 10,0 | 6,0 |

### 5.2.6 T08 — Ground with spatially varying heights and acoustic properties and short barrier




**Key**

S source

R receiver

B barrier

A1 porous ground

A2 mixed ground

A3 reflecting ground

**Figure 10 — Spatially varying heights and acoustic properties and short barrier**

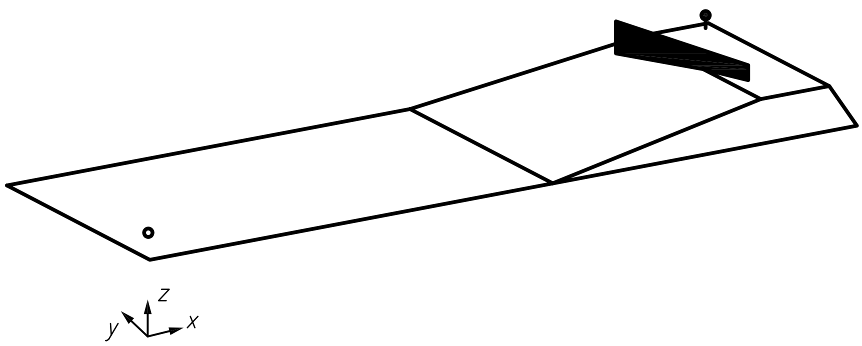



**Figure 11 — 3D presentation of scenario T08**

**Input data:**

**Table 8 — Coordinates of source and receiver**

| | $x$ in m | $y$ in m | $z_{rel}$ in m | $z_{abs}$ in m |
|---|---|---|---|---|
| Source | 10 | 10 | 1 | 0 |
| Receiver | 200 | 50 | 4 | 14 |

Source emission frequency spectrum – Table 2 (Test case T01)

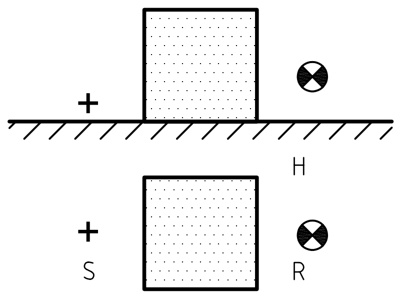
Areas with different acoustic properties – Table 3 (Test case T04)

Contour lines to describe different ground heights – Table 5 (Test case T05)

**Table 9 — Barrier geometry (T08)**

| Upper edge | *x* in m | *y* in m | $z_{abs}$ in m |
|---|---|---|---|
| S1 | 175,0 | 50,0 | 17,0 |
| S2 | 190,0 | 10,0 | 14,0 |

### 5.2.7 T09 — Flat ground with homogeneous acoustic properties and cubic building — receiver at low height




**Key**

S source

R receiver

H object

**Figure 12 — Screening cubic building between source and receiver at low height**

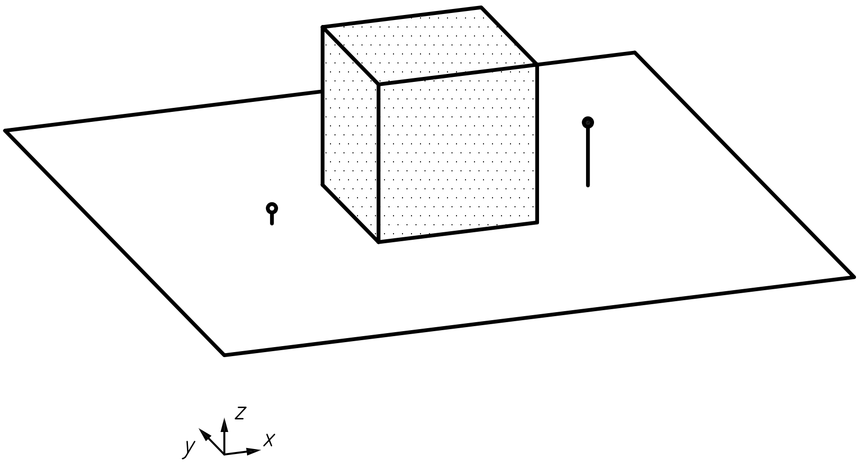



**Figure 13 — 3D presentation of scenario T09**

**Input data:**

**Table 10 — Coordinates of source, S, and receiver, R (T09)**

| | *x* in m | *y* in m | *z* in m |
|---|---|---|---|
| Source | 50 | 10 | 1 |
| Receiver | 70 | 10 | 4 |

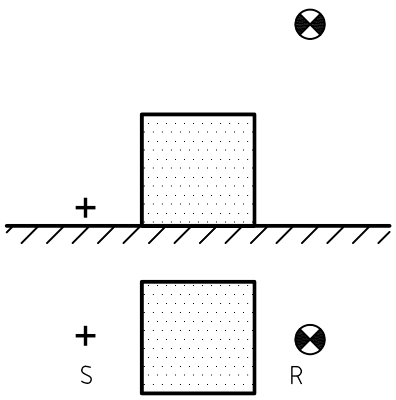
Source emission frequency spectrum – Table 2 (Test case T01)

Mixed ground (e.g. $G = 0{,}5$)

**Table 11 — Edge coordinates of cubic building with a height of 10 m (T09)**

| **Edge no.** | *x* in m | *y* in m |
|---|---|---|
| 1 | 55 | 5 |
| 2 | 65 | 5 |
| 3 | 65 | 15 |
| 4 | 55 | 15 |

### 5.2.8 T10 — Flat ground with homogeneous acoustic properties and cubic building — receiver at large height




**Key**

S source

R receiver

**Figure 14 — Screening cubic building between source and receiver at large height**

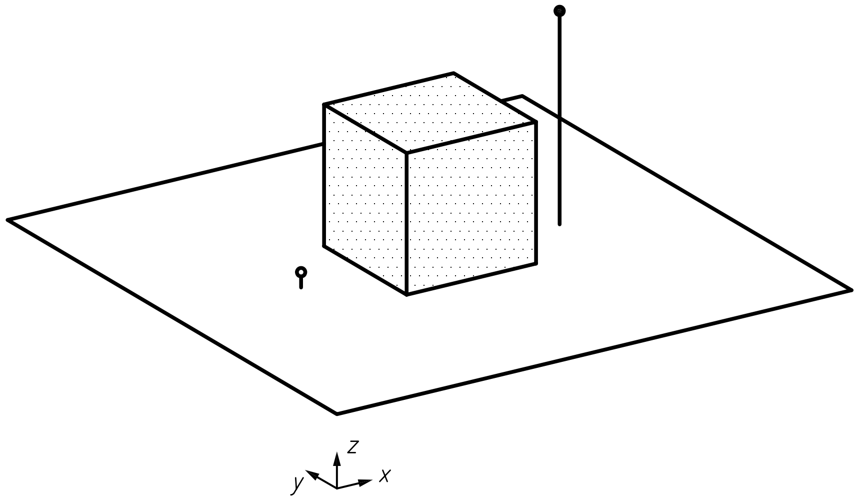



**Figure 15 — 3D presentation of scenario T10**

**Input data:**

**Table 12 — Coordinates of source, S, and receiver, R (T10)**

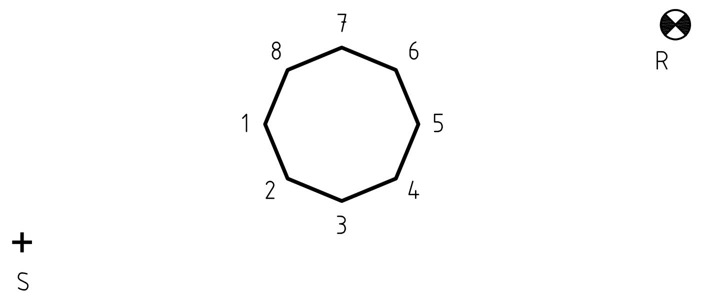
| | ***x*** in m | ***y*** in m | ***z*** in m |
|---|---|---|---|
| Source | 50 | 10 | 1 |
| Receiver | 70 | 10 | 15 |

Source emission frequency spectrum – Table 2 (Test case T01)

Mixed ground (e.g. $G$ = 0,5)

Edge coordinates of cubic building with a height of 10 m, see Table 11 (Test case T09)

### 5.2.9 T11 — Flat ground with homogeneous acoustic properties and polygonal building — receiver at low height




**Key**

S source

R receiver

**Figure 16 — Screening polygonal building between source and receiver at low height**

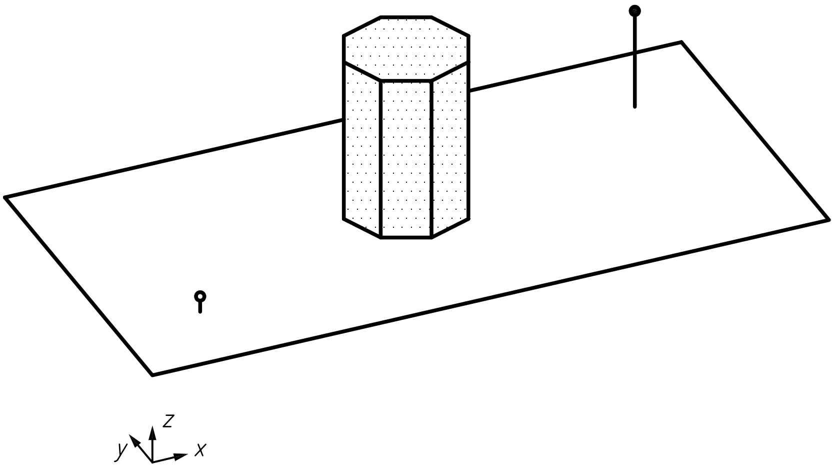



**Figure 17 — 3D presentation of scenario T11**

**Input data:**

**Table 13 — Coordinates of source, S, and receiver, R (T11)**

| | $x$ in m | $y$ in m | $z_{rel}$ in m |
|---|---|---|---|
| Source | 0 | 10 | 1 |
| Receiver | 30 | 20 | 6 |

Source emission frequency spectrum – Table 2 (Test case T01)

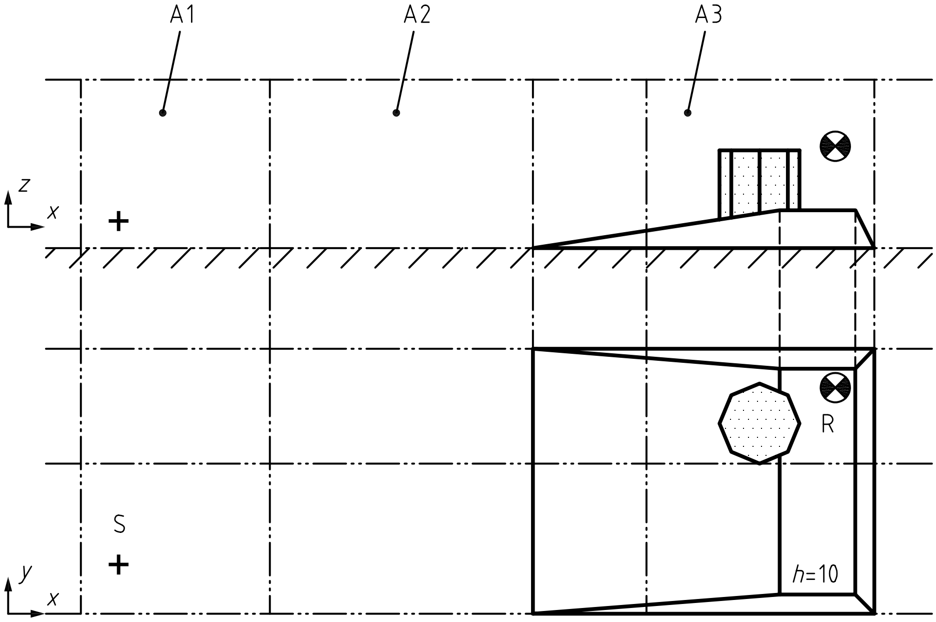
Mixed ground (e.g. $G$ = 0,5)

**Table 14 — Edge coordinates of screening polygonal building with a height of 10 m**

| **Edge no.** | $x$ in m | $y$ in m |
|---|---|---|
| 1 | 10,96 | 15,50 |
| 2 | 12,00 | 13,00 |
| 3 | 14,50 | 11,96 |
| 4 | 17,00 | 13,00 |
| 5 | 18,04 | 15,50 |
| 6 | 17,00 | 18,00 |
| 7 | 14,50 | 19,04 |
| 8 | 12,00 | 18,00 |

### 5.2.10 T12 — Ground with spatially varying heights and acoustic properties and polygonal building




**Key**

S source
R receiver
A1 mixed ground
A2 porous ground
A3 reflecting ground

**Figure 18 — Ground with spatially varying heights and acoustic properties and polygonal building**

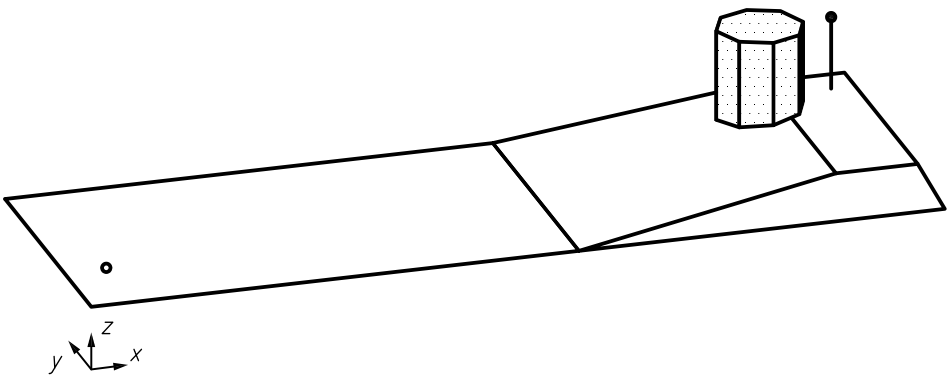



**Figure 19 — 3D presentation of scenario T12**

**Input data:**

**Table 15 — Coordinates of source, S, and receiver, R (T12)**

| | *x*<br>in m | *y*<br>in m | *z*<br>in m |
|---|---|---|---|
| Source | 10 | 10 | 1 |
| Receiver | 200 | 50 | 28,5 |

Source emission frequency spectrum – Table 2 (Test case T01)

Contour lines to describe different ground heights – Table 5 (Test case T05)

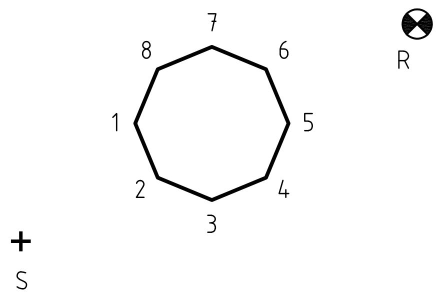
**Table 16 — Areas with different acoustic properties**

| Area | Ground | Coordinates of areas | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $x_1$ in m | $y_1$ in m | $x_2$ in m | $y_2$ in m | $x_3$ in m | $y_3$ in m | $x_4$ in m | $y_4$ in m |
| A1 | mixed | 0 | 60 | 50 | 60 | 50 | −10 | 0 | −10 |
| A2 | porous | 50 | 60 | 150 | 60 | 150 | −10 | 50 | −10 |
| A3 | reflecting | 150 | 60 | 210 | 60 | 210 | −10 | 150 | −10 |

**Table 17 — Edge coordinates of polygonal building with absolute height of 30 m**

| Edge no. | $x$ in m | $y$ in m |
|---|---|---|
| 1 | 169,39 | 41,00 |
| 2 | 172,50 | 33,50 |
| 3 | 180,00 | 30,39 |
| 4 | 187,50 | 33,50 |
| 5 | 190,61 | 41,00 |
| 6 | 187,50 | 48,50 |
| 7 | 180,00 | 51,61 |
| 8 | 172,50 | 48,50 |

### 5.2.11 T13 — Flat ground with homogeneous acoustic properties and polygonal building — receiver at large height




**Key**

S source

R receiver

**Figure 20 — Flat ground with homogeneous acoustic properties and polygonal building — receiver at large height**

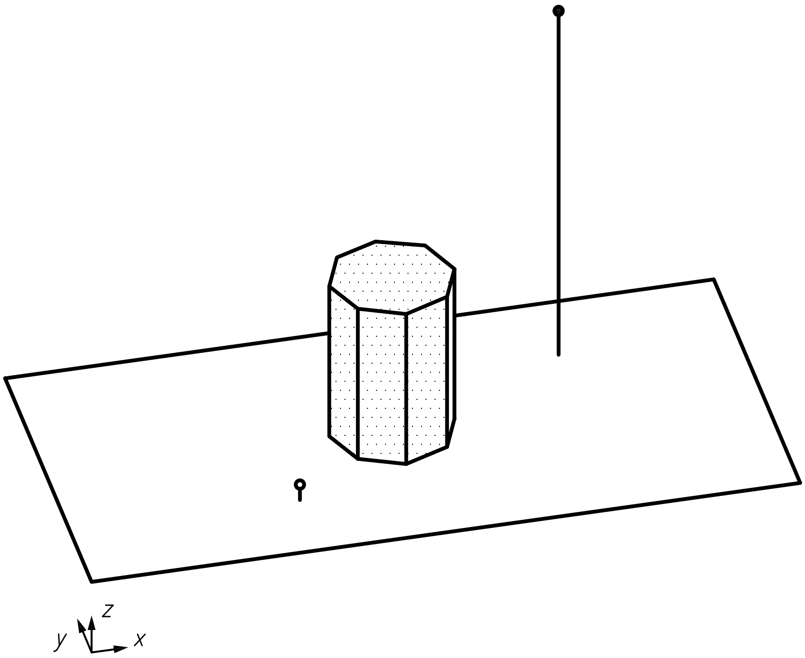



**Figure 21 — 3D presentation of scenario T13**

**Input data:**

**Table 18 — Coordinates of source, S, and receiver, R (T13)**

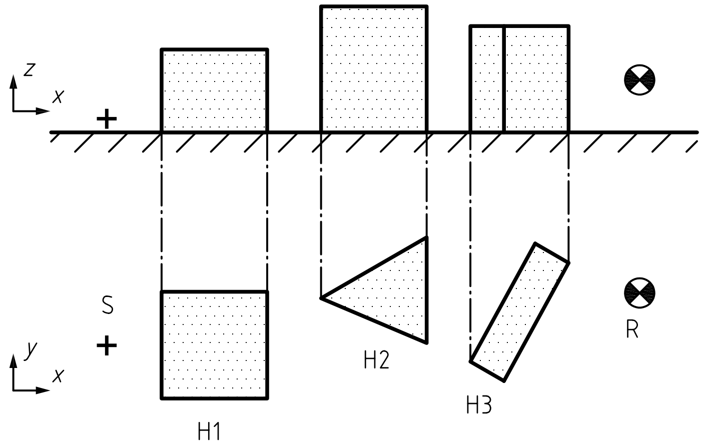
| | ***x*** in m | ***y*** in m | ***z*** in m |
|---|---|---|---|
| Source | 8 | 10 | 1 |
| Receiver | 25 | 20 | 23 |

Source emission frequency spectrum – Table 2 (Test case T01)

Reflecting ground (e.g. $G$ = 0,2)

Edge coordinates of polygonal building with a height of 10 m, see Table 14 (Test case T11)

### 5.2.12 T14 — Flat ground with homogeneous acoustic properties and three buildings




**Key**

S source

R receiver

H1, H2, H3 buildings

**Figure 22 — Three screening buildings (H1, H2, H3) between source and receiver**

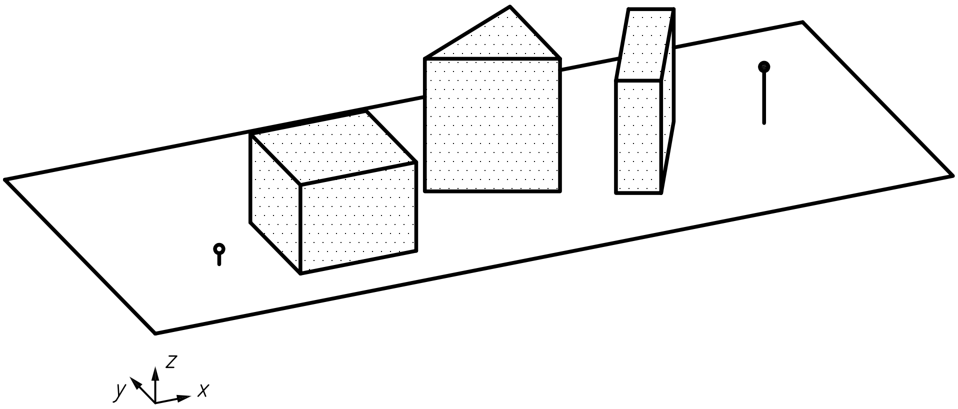



**Figure 23 — 3D presentation of scenario T14**

**Input data:**

**Table 19 — Coordinates of source, S, and receiver, R (T11)**

| | *x* in m | *y* in m | *z* in m |
|---|---|---|---|
| Source | 50 | 10 | 1 |
| Receiver | 100 | 15 | 5 |

Source emission frequency spectrum – Table 2 (Test case T01)

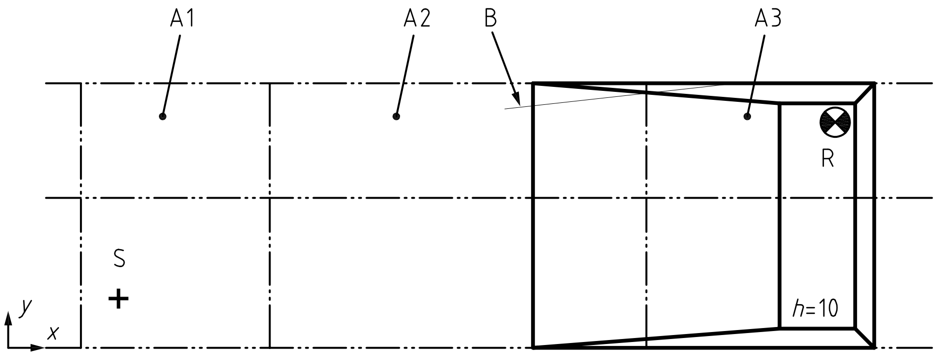
Mixed ground (e.g. $G$ = 0,5)

**Table 20 — Edge coordinates of three buildings with height, *z***

| Edge no. | building H1 | | | building H2 | | | building H3 | | |
|---|---|---|---|---|---|---|---|---|---|
| | *x* in m | *y* in m | *z* in m | *x* in m | *y* in m | *z* in m | *x* in m | *y* in m | *z* in m |
| 1 | 55,00 | 5,00 | 8,00 | 70,00 | 14,50 | 12,00 | 90,11 | 19,48 | 10,00 |
| 2 | 65,00 | 5,00 | 8,00 | 80,00 | 10,17 | 12,00 | 93,27 | 17,78 | 10,00 |
| 3 | 65,00 | 15,00 | 8,00 | 80,00 | 20,17 | 12,00 | 87,27 | 6,61 | 10,00 |
| 4 | 55,00 | 15,00 | 8,00 | | | | 84,11 | 8,31 | 10,00 |

### 5.2.13 T15 — Ground with spatially varying heights and acoustic properties and reflecting barrier




**Key**

S source
R receiver
B barrier
A1 porous ground
A2 mixed ground
A3 reflecting ground

**Figure 24 — Scenario identical to T05, but with reflecting barrier**

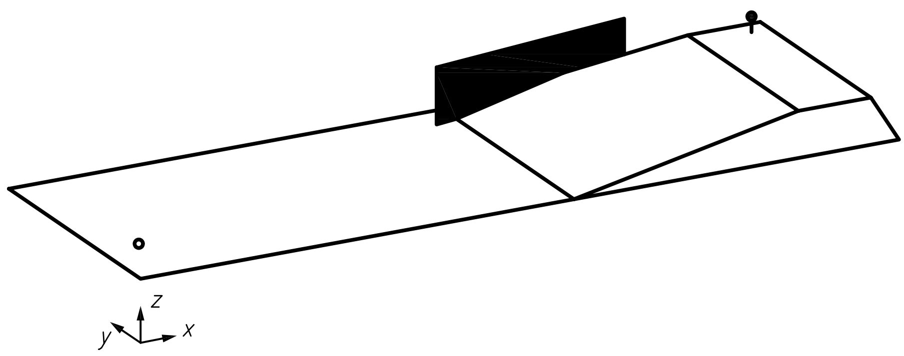



**Figure 25 — 3D presentation of scenario T15**

**Input data:**

All input data and environmental conditions identical to T05, but one additional barrier:

**Table 21 — Coordinates of upper edge of barrier**

| Barrier | *x*<br>in m | *y*<br>in m | *z*<br>in m |
|---|---|---|---|
| S1 | 114,0 | 52,0 | 15,0 |
| S2 | 170,0 | 60,0 | 15,0 |

**Table 22 — Absorption coefficient in octave bands of the barrier surface**

| Quantity | Unit | Values | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $f$ | Hz | 63 | 125 | 250 | 500 | 1 000 | 2 000 | 4 000 | 8 000 |
| $\alpha_{Barrier}$ | | 0,1 | 0,2 | 0,3 | 0,4 | 0,5 | 0,6 | 0,7 | 0,5 |

(Will be continued)

## 6 Quality Assurance Interface[2)]

The quality assurance interface is completely documented in Reference [2]. The elements of format description independent from specific calculation method will be included in this part of ISO 17534 in the next version.

2) The Quality Assurance Interface (QA) is just under preparation.

# Bibliography

[1] ISO 9613-2:1996, *Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation*

[2] Dokumentation zur Qualitätssicherung von Software zur Geräuschimmissionsberechnung nach DIN 45687; 1. Dokumentation-QSI-Datenschnittstelle-DIN 45687 – Fassung 2011-07.1, Beuth Verlag, Germany (English in preparation; en: Documentation for quality assurance of software for the calculation of sound exposure outdoors; 1 Documentation-QSI-Data-Interface-DIN 45687 – Version 2011-07.1)

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