BS 4142: 2014

Uncertainty

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10.1 General

Consider the level of uncertainty in the data and associated calculations. Where the level of uncertainty could affect the conclusion, take reasonably practicable steps to reduce the level of uncertainty. Report the level and potential effects of uncertainty.

Good practice, now explicit. Uncontroversial?

B.1 General

*Because this standard is **not** intended to provide **a single** numerical **value** against which the significance of a sound source can be determined, consideration needs to be given to the uncertainties involved in sound level measurements and subsequent assessment of data, together with the potential effects of such uncertainties on the outcome of the assessment. It is not appropriate to numerically estimate the uncertainty and simply make an allowance for this value in any assessment. Instead, an **appropriate consideration of uncertainty** based on professional judgement can **enable an informed decision** to be made regarding the likely significance of the impact of sound, whilst considering the **range of likely levels and context of the assessment**.*

Outcome range; Uncertainty effect on impact significance

Uncertainty of measured values

Instrumentation uncertainty usually relatively small

Many other, usually more significant, factors:

* Complexity and relationship between specific & residual sounds
* Locations of measurements, source(s), receiver
* Measurement durations, times, number, conditions – weather/ operating, …
* Technique/ competence: data recording (rounding, observations), parameters, …

Measurement Good Practice

Good practice is essential:

* Minimise instrumentation uncertainty
* Minimise uncertainty & error in measured levels
* Obtain representative measurements
* Understand likely causes and magnitude of measurement uncertainty

Annex B draws on the Salford Guide (Craven & Kerry 2007)

Good Practice Guidelines

Consider:

* Standing waves/ interference
* Point/ line/ area sources – near & far field
* Source: configuration, condition, height, location(s)
* Weather: measurement effect, residual variability
* Transmission path: ground effects, barriers/ foliage
* Receiver: representative background, equipment reliability
* Survey duration, reporting, data storage

Measurement variability

Usually significant spatial and temporal variability

* Select location(s) to control/ understand spatial effects
* Select duration, timing, measurement quantity, conditions to understand temporal effects

Highly variable level – greater uncertainty, longer measurement period

Steady level – less uncertainty, shorter measurement period may be appropriate

Interaction between residual and specific levels

Uncertainty in calculations

Due to several factors:

* Measured levels
* Source variability
* Calculation method
* Modelling
* Calculation error

Effect of measurement uncertainty on calculations

Uncertainty in measured residual level introduces uncertainty when calculating specific level

Varying residual/ specific levels exacerbate this uncertainty

Consider effects on and minimise potential calculation uncertainty when preparing for and taking measurements

Effect of source variability on calculations

Source level likely to vary in level and character

Duration and possibly timing of different levels/ characteristics will affect specific levels

Obtain sufficient data to properly understand and assess the effects of source variability

Effect of calculation method

Use validated methods for calculations sound power levels, sound propagation etc. such as ISO 9613-2, BS EN ISO 374x

If an alternative calculation method is used, fully describe the method and state the reasons for using this method.

Effect of modelling on calculations

Any acoustic model is a simulation of reality and introduces additional uncertainty in addition to that of the calculation method e.g. how is a building/ bund modelled as a barrier?

Ensure any modelling minimises additional uncertainty and consider as part of the assessment

Effect of calculation error

Standard systems can reduce the likelihood of errors but do not guarantee their absence.

Check the implementation of the calculation method for errors.

Effect of Uncertainty on Assessment

Assessment result is a range, not a single value

Magnitude of the range will depend not only on Uncertainty but other factors such as the variability of the residual and specific levels

Uncertainty may be insignificant for a very clear assessment outcome, but may significantly affect the outcome if borderline

Precision or Accuracy?

Precision often gives misleading impression of accuracy

Sound levels quoted to nearest integer despite uncertainty of at least several dB

Need to clarify these factors when reporting

Questions (if any remaining uncertainty)?