The ‘New’ BS 4142:2014

Methods for rating and Assessing Industrial and Commercial Sound

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BS4142

• 2014 vs previous versions
• Scope of BS4142
• Concepts of BS4142
• Making measurements
• Corrections for character of the noise source under investigation
• Context
• Uncertainty
What is BS4142?

• One of the most widely used UK standards for assessment of environmental noise.

• The document is British Standard 4142:2014 and its title is ‘Methods for rating and assessing industrial and commercial sound’

• The standard is basic in principle but the detail can be complex. If you wish to use it, a copy of the latest version will be required.
2014 vs Previous Revision

- Need to state credentials of the author to demonstrate competence
- Consideration of the context of the report
- Clarification on which scenarios are suitable and which are not
- Higher level of metrological data to be included
- Night time measurement periods altered from 5mins to 15mins
- Exclusion of the use of Class/Type 2 instruments
- Graduated correction for Tonal Noise
- Gradual scale for Impulse noise penalties
- Consideration of levels of uncertainty
BS4142 – Scope

Used for:

• investigating complaints;

• assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature

• assessing sound at proposed new dwellings or premises used for residential purposes.
BS4142 - Scope

Not Used for

• Noise nuisance – Use statutory noise nuisance powers
• Public road and railway (CRTN and CRN)
• Motorsport/ Music Events
• Shooting grounds (CIEH guidance)
• Construction, Demolition (BS 5228)
• Domestic animals
• People/ PA systems
• Other sources falling in the remit of other standards
The main concepts of BS 4142 is as follows:

• make measurements of all noise at the assessment location, including the "problem" noise, in terms of LAeq - termed the "ambient" noise level

• a measurement is then made of all the noise excluding the "problem" noise in terms of both LAeq and LA90; these measurements are termed the "residual" and "background" noise levels respectively.

• the "residual" LAeq measurement is then subtracted (logarithmically) from the "ambient" LAeq measurement to produce the noise level produced by the "problem" noise alone - termed the "specific" noise level
The main concepts of the standard is as follows:

- If the "problem" noise is tonal [containing a noticeable hiss, whine or hum] or if it is impulsive [contains bangs clatters, clicks or thumps] or if it is irregular enough to attract attention, a correction is added to the "specific" level to produce the "rating level".

- The "background" LA90 measurement is then compared against the "rating" level.

- If the "rating" level exceeds the "background" by around 10 dBA or more, this "indicates a significant adverse impact". A difference of around 5 dBA "indicates an adverse impact"; at a difference below 5 dBA, the lower the adverse impact and below 0dBA – Low adverse impact likely – ‘All dependant on the context’
Making Measurements

- Measurements of the sound level
  - When the source is running - LAeq
  - When the source is Not running - LAeq
  - Background noise when the source is not running – LA90. This should be based on the mode of the LA90 measurements. I.e the most common LA90 value not the lowest.

Measurement time periods
- Day 1 Hour (7am to 11pm)
- Night 15 Minutes (11pm to 7am)

Duration of measurement or number of sample periods will depend on how stable the source and background noise is.
Making Measurements

Where to measure
• At nearest residential premises – Garden
• Possibly at other noise sensitive receptors
• Site of proposed dwellings

If you cannot measure with the specific sound off then it is possible to measure at equivalent location for background and residual noise. Make sure it is representative!
• Microphone position at ear height 1.2 to 1.5m
• 3.5m at least away from reflecting facades
What to Measure

Set your sound level meter to measure

• LAeq and LA90

• Frequency analysis 1/3 Octaves, audio recordings, fast time data logging 25ms or quicker for impulsive calculations.

Alternatively – Prediction can be used to calculate specific noise levels.
Tonal Penalty Options – Annex D

Subjective
• 2dB – Just Perceptible
• 4dB – Clearly Perceptible
• 6dB – Highly Perceptible

Objective
• The 6dB penalty is also applied instead of the above if the adjacent 1/3 octave values;
• Exceeds by 15dB from 25Hz-125Hz
• Exceeds by 8dB from 160-400Hz
• Exceeds by 5dB from 500-10kHz
Objective continued – Method 3 is preferred (complex)

• Uses FFT in accordance with ISO 1996-2 to determine the tones.

• calculation of the tonal audibility compared to adjacent frequencies

Record a high resolution audio recording and ask the software to calculate the tones.
Tonal Example

<table>
<thead>
<tr>
<th>Frequency [Hz]</th>
<th>Kt [dB]</th>
</tr>
</thead>
<tbody>
<tr>
<td>114.26</td>
<td>3.46</td>
</tr>
<tr>
<td>257.81</td>
<td>.00</td>
</tr>
</tbody>
</table>
Impulsive Correction – Annex E

Subjective
• 3dB – Just Perceptible
• 6dB – Clearly Perceptible
• 9dB – Highly Perceptible

Objective – Nordtest Method (complex)
• The 10ms-25ms A SPL are reviewed
• Difference between start and end of impulse used to calculate the Onset rate. This is turn is used to calculate the Prominance and in turn to calculate Penalty between 0 and 9dB.
Impulsive Correction – Annex E

Time history of the A-weighted sound pressure levels with time weighting F

\[ L_e - \frac{(L_e - L)}{2} \text{ to } L_e \]

NOTE: The figure illustrates the onset rate (OR) and the level difference (LD) for the two most prominent impulses. Gradients of 10 dB/s are indicated with short line segments.
### Impulsive Correction – Annex E

Table E.1  **Examples of the prominence \( P \) and the adjustment \( K_i \) for different sound sources**

<table>
<thead>
<tr>
<th>Sound source</th>
<th>( L_{A_{F_{\text{max}}}} ) dB</th>
<th>Level diff. dB</th>
<th>Onset rate dBs</th>
<th>Prominence ( P )</th>
<th>Adj. ( K_i ) dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background sound ( L_{PA_{F_{\text{E}}} = 40 \text{ dB}} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tyre change, pneumatic tool, L</td>
<td>48</td>
<td>7</td>
<td>38</td>
<td>6.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Tyre change, pneumatic tool, H</td>
<td>67</td>
<td>17</td>
<td>76</td>
<td>8.1</td>
<td>5.5</td>
</tr>
<tr>
<td>Compressed air release, L</td>
<td>48</td>
<td>9</td>
<td>65</td>
<td>7.3</td>
<td>4.1</td>
</tr>
<tr>
<td>Compressed air release, H</td>
<td>67</td>
<td>27</td>
<td>140</td>
<td>9.3</td>
<td>7.8</td>
</tr>
<tr>
<td>Metal hammering, L</td>
<td>54</td>
<td>15</td>
<td>194</td>
<td>9.2</td>
<td>7.6</td>
</tr>
<tr>
<td>Metal hammering, H</td>
<td>75</td>
<td>35</td>
<td>222</td>
<td>10.1</td>
<td>9.2</td>
</tr>
</tbody>
</table>
Impulsive Example
Impulsive Correction – Annex E

Objective – Software Calculations

<table>
<thead>
<tr>
<th>Sound source</th>
<th>Date/Time</th>
<th>Duration</th>
<th>Level diff. [dB]</th>
<th>Onset rate [dBs]</th>
<th>Prominance</th>
<th>Adj. Ki [dB]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory (#1)</td>
<td>06/07/2015 10:59:06.494</td>
<td>00:00:00.200</td>
<td>12.0</td>
<td>77.2</td>
<td>7.8</td>
<td>5.1</td>
</tr>
<tr>
<td>Factory (#2)</td>
<td>06/07/2015 10:59:16.069</td>
<td>00:00:00.300</td>
<td>20.0</td>
<td>53.7</td>
<td>7.8</td>
<td>5.0</td>
</tr>
<tr>
<td>Factory (#3)</td>
<td>06/07/2015 10:59:26.569</td>
<td>00:00:00.250</td>
<td>12.7</td>
<td>66.1</td>
<td>7.7</td>
<td>4.8</td>
</tr>
</tbody>
</table>
Applying Corrections – Caution

• Corrections are cumulative and can be large!
• Software calculations are very useful when justifying penalties.....
• Be careful when running the calculations that they are on the source under investigation!

The user should be sure the sound level originates from the source under investigation before applying penalties

• Bird song nearby is tonal and impulsive.
• Record audio in parallel with measurements so you can be sure what you are analysing.
Context

• Consider the context of the assessment
• Time of day
• Local attitude of residents towards the premises under investigation
• Nature of the neighbourhood
Uncertainty

• Instrumentation – Relatively small uncertainty
• Weather
• Location of measurement (especially proxy locations)
• Measurement duration
• Technique and competence
• Calculation errors if predicting levels
Thank you for your attention
– Any Questions?