



BS 4142:2019 – Methods for rating and assessing industrial and commercial sound – the past, the present and future developments – a history.

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ABSTRACT

BS 4142 is the UK's principal assessment method for quantifying industrial / commercial noise impact. It is surprising to realise that this standard is nearly sixty years old. The first draft of the document that was to become BS 4142 was being prepared in 1962 and was first published early in 1963 as the final report of the Wilson Committee on the problem of noise.

As a young acoustician, I like many others, regarded British, and all standards in general, as tablets of stone that were immutable. As I gained in experience it became obvious that this was not true. In fact all standards are periodically reviewed, every five years in the case of a British Standard, to determine if they still reflect the current available evidence that underpins them.

The current version of BS 4142 would be virtually unrecognisable to those esteemed authors of the Wilson Report all those sixty years ago. This paper traces the history of BS 4142 from its birth in the Wilson Report, through its revisions, many of which were extremely controversial at the time, to its current iteration.

Change is coming with a review and potential revision in 2024 and this paper examines the current developments, both in research and standardisation, that may have significant impacts on this review process and the future development of BS 4142.

1. INTRODUCTION

The Wilson Committee on the problem of noise was appointed in April, 1960, "to examine the nature, sources and effects of the problem of noise and to advise what further measures could be taken to mitigate it." They worked on it for two years and towards the end of 1962 submitted their report to the government which was published in July 1963.

The committee faced the task of examining the problem of noise with, for the most part, no special knowledge of the subject. This lack was in a sense an advantage, for it enabled them to see the problem from the point of view of the layman, and noise affects us all, laymen and specialists alike. They hoped that their conclusions and recommendations would represent fairly the reaction of the ordinary citizen to noise, and the degree of trouble and expense that would be required to mitigate it.

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2. THE WILSON REPORT



COMMITTEE ON THE PROBLEM OF NOISE

Noise

FINAL REPORT

*Presented to Parliament by the Lord President
of the Council and Minister for Science
by Command of Her Majesty
July 1963*

Figure 1: The Wilson Report

2.1. The Wilson Report Introduction

The introduction to the report starts with the following observation.

“People's reactions to noise vary greatly and in the past this has prevented the framing of rules for its control except in qualitative terms, with consequent difficulties of administration. We therefore felt that an important feature of our task was to try to define, wherever possible, quantitative levels of noise which should become statutory limits or where statutory limits were not desirable or could not be laid down at present, to suggest levels which would serve as guides to what is reasonable.”

It is Appendix XV, on “*Simplified procedure for assessing reaction to industrial noise in mixed residential and industrial areas*”, of that report that was to subsequently become BS 4142.

2.2. Appendix XV

This ‘simplified procedure’ was intended as a quantitative guide to whether an existing industrial noise is likely to cause complaint from those people, having a normal reaction to noise, who live nearby, and also to give an indication of the probable limiting level of noise from a proposed factory without likelihood of complaint.

In this procedure for assessment, a basic noise level is first identified and then allowances are added to or subtracted from it in accordance with a set of rules. Comparison of the measured value with the level calculated from the rules is used as an indication of whether complaints may be expected about noise from the industrial premises.



The basic figure was set at 50 dBA for new factories, 55 dBA for factories which have been established for a few years, and 60 dBA for old established factories. Then allowances were added/subtracted for tonality, intermittency, the type of district, and variations in the noise level throughout the day.

The noise level is measured out of doors, approximately 12 ft from the side of the nearest habitable building which faces the noise source at a height of 4 ft above the ground. If the measured noise level in dBA exceeds the limiting level given by the rules as the sum of a basic level and appropriate allowances, then complaints from an ordinary reasonable person may be expected.

The report also stated that there had recently been a great increase in the study of noise problems in their social setting, and they did not doubt that in the coming years important advances would be made. They hoped that their own work would contribute something to this movement and help to put the problem of noise into perspective with other problems of modern life. Not surprisingly that is exactly what happened in the following years.

2.3. BS 4142:1967

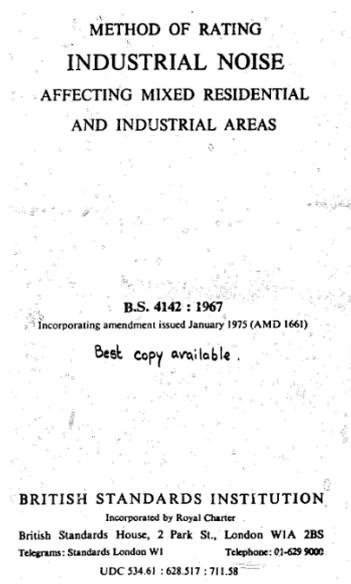


Figure 2: The 1967 edition of BS 4142

It took just four years for the British Standard Institute to convert Annex XV of the Wilson Report into the first version of BS 4142:1967 – Method of rating industrial noise affecting mixed residential and industrial areas. In this version the idea of a basic noise level plus allowances, now referred as a notional background level, sits alongside a suggestion that perhaps you should measure the actual existing background.

For readers who are too young to remember this period of time you need to consider that Leq measurements did not exist and the observer had to ‘eyeball average’ the meter needle. The use of directly measured statistical parameters such as L₉₀ were not even featured in acousticians wildest dreams. It was just possible to create a dB L_{A90} by taking a snapshot measurement by eye every ten



seconds for one hundred measurements. The resultant data could then be examined to establish what the level that was exceeded for 90% of the time, a laborious procedure. It is for that reason that very few practitioners actually measured the true background and that the use of a notional background was prevalent. The standard rates the noise for complaint purposes as follow.

“If the measured noise level exceeds either the measured or notional background by 10 dB(A) or more then complaints may be expected, differences of 5 dB(A) are of marginal significance, and if the measured noise level is 10 dB(A) below the background level that may be taken as a positive indication that complaints ‘are unlikely’.”

This is the origin of the current rating system and it was not really based on a large sample of measured data.

3. BS 4142:1990

Many people are not aware that British Standards are not issued as tablets of stone. They have to be reviewed every five years to ensure that they reflect the then state of scientific knowledge. There were minor amendments made in 1975, 1980, and 1982. However, it took thirteen years for the first full revision to be prepared. This revision is now much closer to the current version and it included definitions of the following:

$L_{Aeq,T}$ and $L_{A90,T}$, both of which could now be measured directly in many standard sound level meters.

Specific noise source	Specific noise level
Reference time interval T_r	Measurement time interval T_m
Rating level	Residual noise
Background sound level	Ambient noise
Steady noise	Traceability of the SLM

The standard now also included three reasonably helpful examples of how to use the standard.

This revision used the rating level for the assessment of the specific noise and subtracted the measured background noise level from it. A difference of around 10 dB or higher indicates that complaints are likely. A difference of around 5 dB is of marginal significance. At a difference below 5 dB, the lower the value the less likelihood there is that complaints will occur. A difference of - 10 dB is a positive indication that complaints are unlikely.

This version begins to hint at ‘uncertainty’ by describing things that could adversely influence the validity of an assessment. It also, for the first time, clearly articulated exactly what should be included in a BS 4142 report. This is now becoming much more familiar to today’s acousticians.

4. BS 4142:1997

The 1997 revision changed very little. The references to other standards that had been revised were updated and a fourth example was added. In essence then the standard had not really developed since 1990.



4. BS 4142:2014

In early 2012 the BSI recognised that BS 4142 had not really evolved despite there being a considerable body of research that had been completed in the previous fifteen years. A major revision of the standard was needed and the BSI committee EH/1/3 set up a small drafting panel consisting of the following five people:

Phil Dunbavin, Drafting Panel Chairman, Chairman of the Association of Noise Consultants.

Bernard Berry, Chairman of EH/1/3 and Chairman of EH/1.

Colin Cobbing, Chartered Institute of Environmental Health.

Tony Clayton, The Environment Agency.

Ken Collins, The Institute of Acoustics.

The starting point was to conduct a literature survey of all the research that had been done world-wide in the intervening years which was a major undertaking. The drafting panel prepared ideas as to what should be included in this revision and then tested them by holding a one day workshop on the 19th of October 2012 in Birmingham.

The workshop was meant to apprise acousticians and environmental health professionals about the ongoing revision process. The workshop also provided an opportunity to debate some of the issues that still require further clarification or development. The workshop was open to acousticians and environmental health professionals who have day to day familiarity with the application of BS: 4142. The intention was to gain from the experience of users in the real world.

The workshop was extremely well attended with practitioners from the whole range of the industry.



Figure 3: Some of the many who attended the workshop.



In addition to the workshop we held evening events at the Institute of Acoustics branches around the country. All this information eventually fed into the draft of the revision that was approved for national consultation.

The draft standard was made publicly available and everyone was encouraged to submit their views as both individual practitioners and as associated bodies/industries. The response to the consultation was over whelming with 945 separate comments submitted. Every single comment had to be reviewed and the respective merits of each discussed and a consensus decision reached as to how to modify the draft standard in response to each comment. This process took many days but eventually a final draft of BS 4142:2014 was finalised.

The revision process had been contentious but was essential and some the key changes were:

- All the references to other standards have been updated.
- It is now a requirement to consider uncertainty.
- Pragmatic approach – minimise causes of uncertainty.
- New to this revision of the standard is the introduction of uncertainty and this includes good practice for reducing uncertainty.
- The section of examples in Annex A has been considerably expanded and from four to nine.
- This revision of the standard now recognises the importance of the context in which the sound will/does exist.
- Only Type or Class 1 instruments are acceptable.
- Record the weather conditions that may affect the measurements. Wind speed must be monitored at the measurement location using an anemometer together with the wind direction.
- Evaluate the specific sound over an appropriate reference time interval typically: 1 h during the day; 15 min during the night.
- For the purposes of this standard daytime is defined as the hours between 07:00 and 23:00 hours, night time is defined as the hours between 23:00 and 07:00 hours.
- If the sound contains a tone, whine, etc, then the reference method for assessing the audibility of tones (Annex E) produces a penalty on a sliding scale from 0.0 to 6.0 dB and should be used when the simplified method is inconclusive
- An objective method for measuring the prominence of impulsive sounds may be used (Annex F), which produces penalties on a sliding scale typically in the range 0.0 to 9.0 dB
- Ensure that the measurement time interval is sufficient to obtain a representative value of the background sound for the period of interest. This should comprise continuous measurements of not less than 15 minutes intervals which may be contiguous or disaggregated.
- In practice there is no ‘single’ background sound level as the level will vary throughout the day and throughout the year.
- Assess the impacts by subtracting the measured background sound level from the rating level.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around + 5 dB could be an indication of an adverse impact, depending on the context.



- The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an adverse impact.

5. BS 4142 :2014 A1 2019

Unfortunately when the revised standard was published the drafting panel did not have the opportunity to check the type setting and it contained numerous errors which fortunately did not affect the application of the standard. Consequently these errors were corrected in 2019 with amendments that fall broadly into four areas:

- Typographical and typesetting errors
- Missing incorrect, or confusing words
- Clarifications
- Improvements to the examples

This then is the current version of the BS 4142.

6. THE FUTURE

Change is coming with a review and potential revision in 2024 and there are current developments, both in research and standardisation, that may have significant impacts on this review process and the future development of BS 4142.

6.1 Research

A research project has been launched by Salford University to examine areas where the evidence base for BS 4142 is currently thin and to provide guidance on how the standard can be strengthened. The method allows for corrections to be applied to measured sound levels designed to account for the perceptual effect of different noise characteristics.

Corrections for tonal, intermittent, and impulsive characteristics of the industrial noise source can be applied cumulatively, potentially allowing corrections of up to 18 dB. However, the evidence base for the corrections is weak and anecdotal accounts suggest there is significant variance between practitioners in their application.

Furthermore, the literature on auditory attention, distraction and soundscape suggests that several potentially significant variables (such as differences between expert and lay listeners) are not accounted for. A recent industry workshop at Salford University considered the problems with BS 4142 and, in six small groups, identified the research questions, objectives, methods and stakeholders needed to produce a more rigorous assessment method.

This research has been delayed considerably by the pandemic. It is highly probable that there is other research being undertaken by other bodies which will feed into the next revision. The one area that practitioners have all agreed on is that the current revision does not provide any framework for the consideration of context.



6.2 Soundscape

The issue of context will be helped by the recent development of the Soundscape series of ISO standards. Soundscape represents a paradigm shift from noise control policies towards a new multi-disciplinary approach as it involves not only physical measurements, but also humans and social sciences with a focus on how people actually experience an acoustic environment in context.

Soundscape is defined as ‘the acoustic environment as perceived or experienced by and/or understood by a person or people, in context’. Much has been debated in recent years about exactly what ‘context’ is in the light of BS4142:2014.

In soundscape, the context is meant as the physical place where the acoustic environment exists and according to the ISO definition, it ‘includes the interrelationship between person and activity and place and time and may influence soundscape through the auditory sensation, the interpretation of auditory sensation, and the response to the acoustic environment’.

Part 3 of the Soundscape series of standards provides guidance on how to analyse data collected. Part 4 is currently under development and will address the issue of ‘interventions’ to change a sound scape.

6.3 Summary

It is by no means clear yet as to how BS 4142 will develop into the future. There is little doubt that it will be based on the firmest foundation of evidence to further improve its assessments.

7. ACKNOWLEDGEMENTS

I would like to gratefully acknowledge the assistance provided by the BSI in digging out the long superseded versions of the BS 4142 standard from their copious library.

8. REFERENCES

ISO TS 12913 consists of the following parts under the general title *Acoustics – Soundscape*:

- Part 1: Definitions and conceptual framework
- Part 2: Data collection and reporting requirement
- Part 3: Data analysis
- Part 4: is currently in development.