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consultants in acoustics, noise and vibration

CIEH SE Regional Forum 31st March 2011

BS 4142 and low noise environments

BS 4142 and what constitutes a 'representative background noise level'

BS 8233 and its impending revision – review and discussion as to content and how the Standard can be improved

by Philip Evans, Director



Agenda

- Southdowns
- BS 4142 and low noise environments
- BS 4142 and what constitutes a 'representative background noise level'
- BS 8233 and its impending revision
- Q&A



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The Company

- Formed in 1996
- Noise and Vibration Specialists
- 9 Consultants + 3 Directors
- Office in Lewes
- ISO 9001 accredited
- Members of the Assoc. of Noise Consultants
- Members of Institute of Acoustics
- Link-up, Constructionline and UVDB
- CSCS
- CHAS



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Professional Expertise / Positioning

- 4 Expert Witnesses (18 to 25 yrs experience)
- BSi Committees (BS 6472, BS 5228, BS 8233)
- ANC Red Book co-author
- ANC Green Book co-author (in preparation)
- Various IOA Working Groups
- 4 Consultants - MSc Applied Acoustics
- 2 Registered Sound Insulation Testers
- High Profile Project Involvement



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Current & Recent Projects

- Crossrail Contractors
- Cooling The Tube
- LU Met Line Power Upgrade
- Preston Tithebarn Town Centre
- Traffic Calming – LB Richmond
- Various Academies / Colleges
- Docklands Light Rail – Woolwich Arsenal Ext.
- Environment Agency – Waste Facilities
- Olympic Skeet and Trap Facility
- Super MRF, Wembley
- Southern TOC – Permitted Development
- East London Line
- Crossrail Track Assurance Studies
- Tottenham Court Road Station Upgrade
- Bexhill Hastings Link Road
- Dublin Port Tunnel
- Golden Gate PFSs



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BS 4142 : 1997

Method for Rating industrial noise affecting mixed residential and industrial areas

- Describes methods for determining, at the outside of a building:
 - a) noise levels from factories, or industrial premises, or fixed installations, or sources of an industrial nature in commercial premises; and
 - b) background noise level.



BS 4142 : 1997

- And - describes a method of assessing whether the noise referred to in a) is likely to give rise to complaints from people residing in the building
- But – the method is not suitable for assessing the noise measured inside buildings or when the background **and** rating noise levels are **both** very low
 - The note indicates: background noise levels below about 30 dB and rating noise levels below about 35 dB are considered to be **very** low



BS 4142 : 1997

- **How is the Standard used?**
- The Rating Level, which may be corrected for acoustic features, is compared with the 'representative' background noise level
- The greater the difference between the two when the difference is positive, the greater the likelihood of complaints:
 - a difference of **around** + 10 dB or more indicates that complaints are likely
 - a difference of **around** + 5 dB is of marginal significance
 - if the rating level is more than 10 dB **below** the measured background noise level, then this is a positive indication that complaints are unlikely



BS 4142 : 1997

- **Issues:**
- What do you do when the background **and** the rating noise levels are **both** very low?
- What do you do if only the background **or** the rating noise level is very low?
- What constitutes a 'representative' background noise level and why is this important?



BS 4142 : 1997

What do you do when the when the background **and
rating noise levels are **both** very low**

- **Options:**
- carry out a BS 4142 assessment anyway – probably not!
- assess noise effects using other methods:
 - Noise change L_{Aeq} to L_{Aeq}
 - BS 8233/WHO guidance, i.e.
 - Whether combined daytime levels in gardens or balconies are in excess of 50/55 dB(A)
 - Whether combined internal levels with windows partially open exceed the good or reasonable standard in BS 8233, i.e. 30/40 dB L_{Aeq} for living rooms/30/35 dB L_{Aeq} and 45 dB L_{Amax} for bedrooms
 - As above but with windows closed



BS 4142 : 1997

What do you do if only the background **or** the rating noise level is very low

- **Options:**
- carry out a BS 4142 assessment anyway – probably!
- but also assess noise effects using other methods:
 - Noise change L_{Aeq} to L_{Aeq}
 - BS 8233/WHO guidance, i.e.
 - Whether combined daytime levels in gardens or balconies are in excess of 50/55 dB(A)
 - Whether combined internal levels with windows partially open exceed the good or reasonable standard in BS 8233, i.e. 30/40 dB L_{Aeq} for living rooms/30/35 dB L_{Aeq} and 45 dB L_{Amax} for bedrooms
 - As above but with windows closed



BS 4142 : 1997

What constitutes a 'representative' background noise level

- **There is some guidance as to when to take the measurements but not for how long nor sampling duration**
- **There is no recognition of the variability of the L_{A90}**
- **There are many ways to process the data**
- **Why does it matter?**
- **Assuming the Rating Level is fixed/agreed, variations/differences in any assumed background level can make significant differences to an assessment**
- **It may be appropriate to take a different background level or a background level processed in a different way for day, evening and night-time periods -**



BS 4142 : 1997

What constitutes a 'representative' background noise level

- Daytime (07:00 to 19:00 hrs) has relatively steady levels
- Evening (19:00 to 23:00 hrs) has relatively steady levels but different to daytime
- Night-time (23:00 to 07:00 hrs) includes the end of the evening period, the lowest levels in the middle of the night and the beginning of the daytime period – this results in a significant variation in levels through the period



BS 4142 : 1997

What constitutes a 'representative' background noise level

- **An example based upon a recent case for a metal recycling centre:**
- Another consultant had taken a minimum L_{A90} from between 22:00 and 23:00 hrs – 41 dB(A)
- The working hours for the site were 08:00 to 18:00 – the minimum for this period was 44 dB(A)
- The average over the working day was 49 dB(A)
- Assuming a Rating Level of 45 dB(A) resulted in differences of +4 dB, +1 dB and – 4 dB – which is right?
- With an impact assessment range of 8 dB(A), taking the right background level is critical!



BS 4142 : 1997

What constitutes a 'representative' background noise level

- **Considerations:**
- What are the working/operating hours of the facility?
- If daytime only, then the representative background should be derived from the period when the site is operating
- If daytime and evening, then the same should occur but you may need to determine whether the daytime and evening period should be allocated different background levels
- If 24 hour, then the three periods may need to be considered separately
- If 24 hour, then you may need to take a background from the night-time to set the design criterion



BS 4142 : 1997

What constitutes a 'representative' background noise level

- **Options (with values from a 24 hr data set as examples):**
- **Minimum L_{A90} over the working period (31 dB(A))**
- **Average (mean) L_{A90} over the working period (43 dB(A))**
- **Median of the L_{A90} over the working period (43 dB(A))**
- **Mode of the L_{A90} over the working period (47 dB(A))**
- **25th percentile over the working period (39 dB(A))**
- **Range = 16 dB(A)!**



BS 4142 : 1997

What constitutes a 'representative' background noise level

- **Suggestions but note these may need to vary with project/sensitivity/area:**
- Daytime – average value
- Evening – average value
- Night-time – minimum or 25th percentile but consider other indicators:
 - Whether combined internal levels with windows partially open exceed the good or reasonable standard in BS 8233, i.e. 30/40 dB L_{Aeq} for living rooms and 30/35 dB L_{Aeq} /45 dB L_{Amax} for bedrooms
 - If yes, consider the contribution from the source in question – if significant, then emissions probably unacceptable and further mitigation required
- But may need to consider creeping background if other sources are present



BS 4142 : 1997

What constitutes a 'representative' background noise level

- **Survey durations and sample intervals:**
- Standard is unhelpful -
 - Note to 7.1.2
 - 7.1.3 – make measurements during periods when the background noise level is typical of the background noise when the specific noise is or will be operating
 - 7.1.4 – similar weather conditions to when the source will operate
- Examples quote 1 sample of 15 mins, 30 mins & 60 mins
- But not sufficient in my view



BS 4142 : 1997

What constitutes a 'representative' background noise level

- **Survey durations and sample intervals:**
- Suggest 15 min samples as follows:
 - Daytime, low sensitivity site – 3, 15 minute discontinuous samples
 - Daytime, moderate sensitivity site – full day of samples
 - Daytime, high sensitivity site – 1 to 2 weeks of samples
 - Daytime and evening – as above but include measurements during the evening period
 - Daytime, evening & night-time – as above but include some attended monitoring during night-time period
- Some attended monitoring & observations always recommended



BS 8233:1999

Sound insulation and noise reduction for buildings – Code of practice

- Current 1999 version prepared by Technical Committee B/209/18
- Originally a BS – CP3: Chapter III: 1972
- Superseded by BS 8233: 1987
- BSi Committee B/564/01 - BS 5228: Noise and Vibration Control on Construction and Open Sites – 2009 ver
- To be revised by panel B/564/-/1 formed of Committee B/564/01 but with other nominees
- Formal consultation via IoA and ANC meetings



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BS 8233:1999

- **Content:**
 - **Introduction**
 - **Terms and definitions**
 - **Symbols**
 - **Measuring equipment and accuracy**
 - **Planning and design**
 - **External noise sources**
 - **Specific types of building**
 - **Sound insulation in buildings and control of noise from building services**



BS 8233:1999

- **Scope of the Standard:**

‘gives recommendations for the control of noise in and around buildings, and suggests appropriate criteria and limits for different situations. These criteria and limits are primarily intended to guide the design of new or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise level. It covers room acoustics for simple situations, but not the design of buildings where the acoustics are critical, such as auditoria.’



BS 8233:1999

- **5. Planning and design:**
 - Describes the process and provides guidance
- **6. External noise sources**
 - Road, aircraft, railways, industry and construction
 - Design problems
- **7. Specific types of building**
 - Design criteria
 - Guidance for specific types of building – Tables 5 & 6



Table 5 — Indoor ambient noise levels in spaces when they are unoccupied

Criterion	Typical situations	Design range $L_{Aeq,T}$	
		dB	
		Good	Reasonable
Reasonable industrial working conditions	Heavy engineering	70	80
	Light engineering	65	75
	Garages, warehouses	65	75
Reasonable speech or telephone communications	Department store	50	55
	Cafeteria, canteen, kitchen	50	55
	Wash-room, toilet	45	55
	Corridor	45	55
Reasonable conditions for study and work requiring concentration	Library, cellular office, museum	40	50
	Staff room	35	45
	Meeting room, executive office	35	40
Reasonable listening conditions	Classroom	35	40
	Church, lecture theatre, cinema	30	35
	Concert hall, theatre	25	30
	Recording studio	20	25
Reasonable resting/sleeping conditions	Living rooms	30	40
	Bedrooms ^a	30	35

^a For a reasonable standard in bedrooms at night, individual noise events (measured with *P* time-weighting) should not normally exceed 45 dB L_{Amax} .

Table 6 — Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important

Criterion	Typical situations	Design range $L_{Aeq,T}$	
		dB	
Reasonable acoustic privacy in shared spaces	Restaurant	40-55	
	Open plan office	45-50	
	Night club, public house	40-45	
	Ball room, banquet hall	35-40	
	Reception room	35-40	

7.6.1A Other precautions

It is recommended that any partition separating a WC from a noise sensitive room should have a weighted standardized level difference ($D_{nT,w}$) of at least 38 dB.

In flats, sound absorbent materials should be applied to the ceiling surfaces of internal corridors and stairwells to reduce propagation of noise through the building.

NOTE Carpets can also provide useful absorption.

Resilient floor coverings, such as carpet with underlay, can be used to minimize noise from footsteps on stair treads, corridors and landings. Noise will be reduced at the same floor level and to rooms below the floor or stair. The quietest types of sanitary, heating and plumbing equipment (e.g. WCs, ball valves, refuse chutes etc.) should be used; however their location is more important than their detailed design.

It is good practice to isolate vibration in the heating pipework from the building structure, at least near the pump. This may be achieved by using resilient fixings on pipe runs. Where pipes penetrate walls and floors, air gaps should be sealed to reduce airborne noise transmission in such a way that structure-borne noise is not transmitted; this may be achieved by packing the gap with mineral wool, and sealing the faces with non-hardening mastic. Building Regulations guidance for fire safety should be taken into account [24], [25], [26]. Ventilation fans and similar equipment should have resilient mountings where structure-borne noise could be a problem.

Care should be taken to position lifts to minimize noise disturbance from the operation of the control gear. Lift doors should operate quietly, and acoustic signals to herald lift arrival should not be audible within dwellings.

NOTE For additional guidance see [10].



BS 8233:1999

- **8. Sound insulation in buildings and control of noise from building services**
 - Flanking transmission
 - SITs
 - Sound insulation characteristics of building elements
- **Annex A – Noise calculations**
- **Annex B – Noise rating**
- **Annex C - Specification of sound insulation**
- **Annex D – Special problems requiring expert advice**
- **Annex C - Airborne and impact sound insulation**



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BS 8233:1999

Sound insulation and noise reduction for buildings – Code of practice

- **What's good about the Standard**
- **Should the content be changed/improved**
- **Should anything be removed or added**
- **Other comments or observations**



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Q&A



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