AVO Guide – Indoor Ambient Noise Levels

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Indoor Ambient Noise Levels (IANL)

- The guide introduces indoor levels to assess:

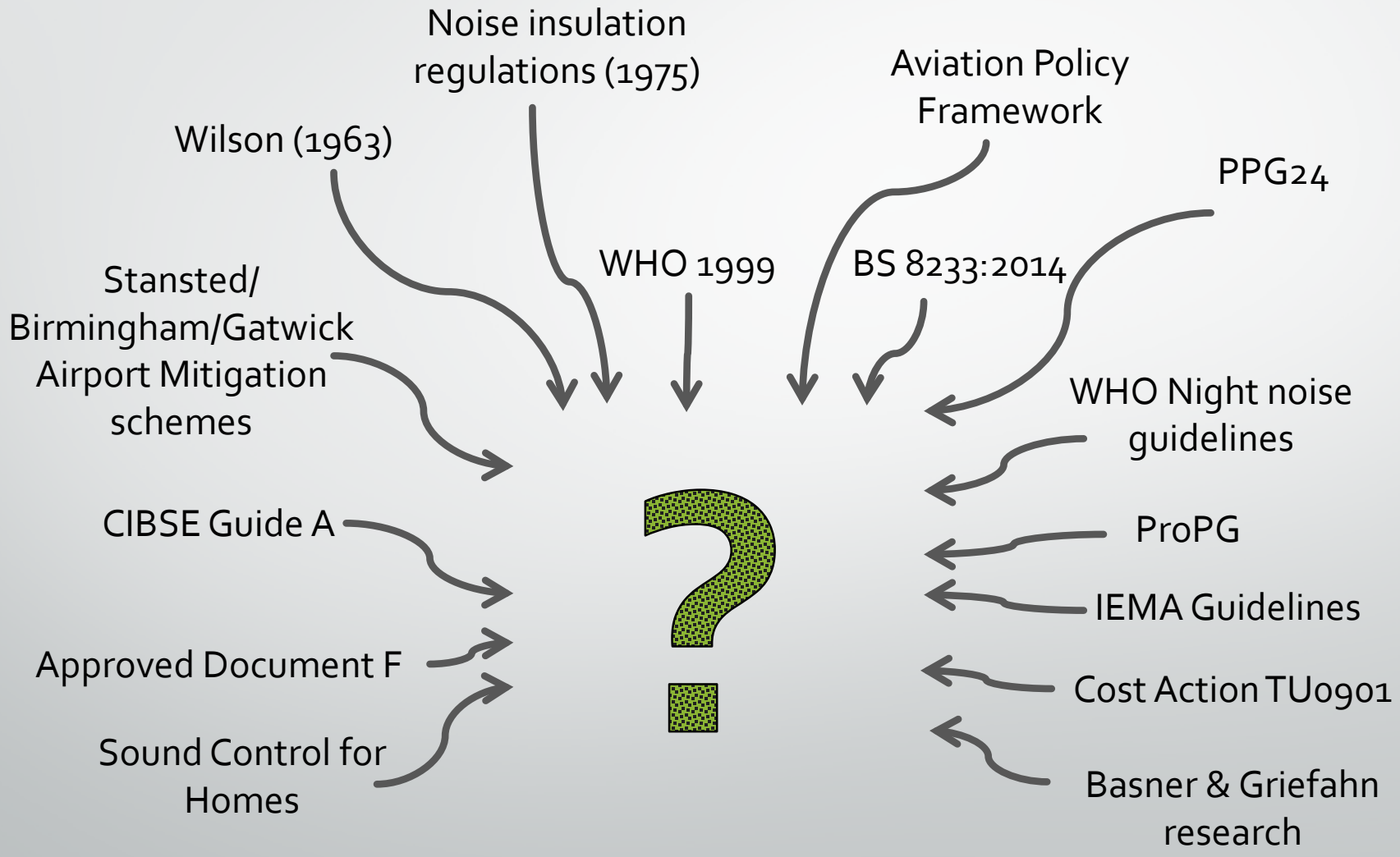
1. Guideline Internal noise levels for "normal" or ADF ventilation condition:
2. Guideline noise levels for overheating condition: and
3. Guideline noise levels for noise from mechanical services.

Relevant noise effects

- **Daytime**
  - Annoyance
  - Task Interference (Conversation/Telephone)
- **Night-time**
  - Sleep disturbance based on dB L_{Aeq}
  - Sleep disturbance from individual noise events based on dB $L_{AF,max}$, SEL, dB $L_{AS,max}$

Guideline noise levels needed to assess sound levels for both "normal" or **whole dwelling ventilation** and also **relaxed standards for the overheating condition**.

Current guidance – noise effects



Current guidance – noise effects

- BS 8233:2014

Table 4 **Indoor ambient noise levels for dwellings**

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

- ‘Reasonable’ = + 5 dB

Current guidance – noise effects

- BS 8233:2014

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A decision must be made regarding the appropriate averaging period to use. The averaging period should reflect the nature of the noise source, the occupancy profile and times at which overheating might be likely to occur. Further guidance can be found within the 2014 IEMA Guidelines

Table 3-1 Indoor Ambient Noise Levels resulting from transport noise sources - ADF ventilation condition

Ventilation condition	Operational condition of System	Desirable internal ambient noise level from transport noise sources
Part F - Whole dwelling ventilation	Systems 1 & 2: Background ('trickle') ventilators open to provide whole dwelling ventilation in the winter period. Additional ventilation required at other times of the year – windows are assumed to be ajar for assessment [Note 2].	Guideline values from Table 4 of BS 8233:2014.
	System 3: Continuous mechanical extract with background ('trickle') ventilators open [Note 2].	
	System 4: Continuous mechanical supply and extract with heat recovery (MVHR) – no trickle vents required.	
Part F – Purge Ventilation [Note 1]	Option 1: Opening external window(s) meeting requirements described in Appendix B of Part F.	No specific acoustic criterion needs to be met in a room using purge ventilation for the purpose of rapidly diluting indoor pollutants.
	Option 2: Manually controlled fan extracting 4 air changes per hour.	

- For normal or whole dwelling ventilation rate guideline values from BS8233:2014 should be used.
- All three aspects of noise exposure (i.e. daytime, night-time and individual noise events) should be evaluated
- No specific noise event guideline in Table 3-1.

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	Option 2: Manually controlled fan extracting 4 air changes per hour.	

- ADF has a clearly defined objective definition of purge ventilation to rapidly dilute pollutants and/or water vapour for indoor air quality purposes. This is defined as 4 air changes per hour in Appendix A of the Approved Document. **This is used for occasional activities such as painting and decorating or accidental releases such as smoke from burnt food or spillage of water.** Provisions for purge ventilation can also be used to improve thermal comfort. This is not controlled under the Building Regulations

Overheating condition – task interference

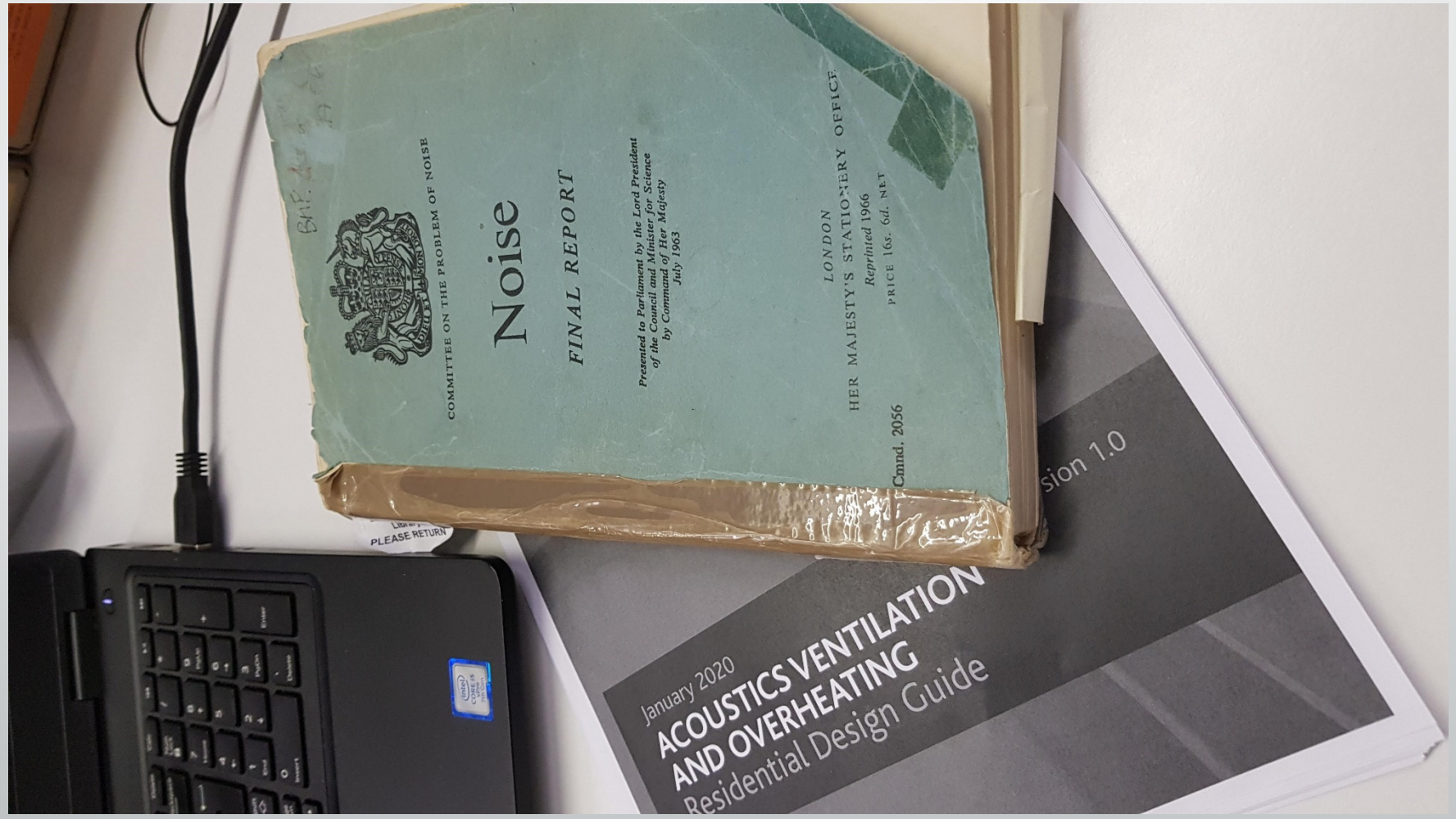
- BS 8233:2014 – speech communication

Table 7 **Maximum steady noise levels for reliable speech communication**

Distances between talker and listener m	Noise level dBA	
	Normal voice	Raised voice
1	57	62
2	51	56
4	45	50
8	39	44

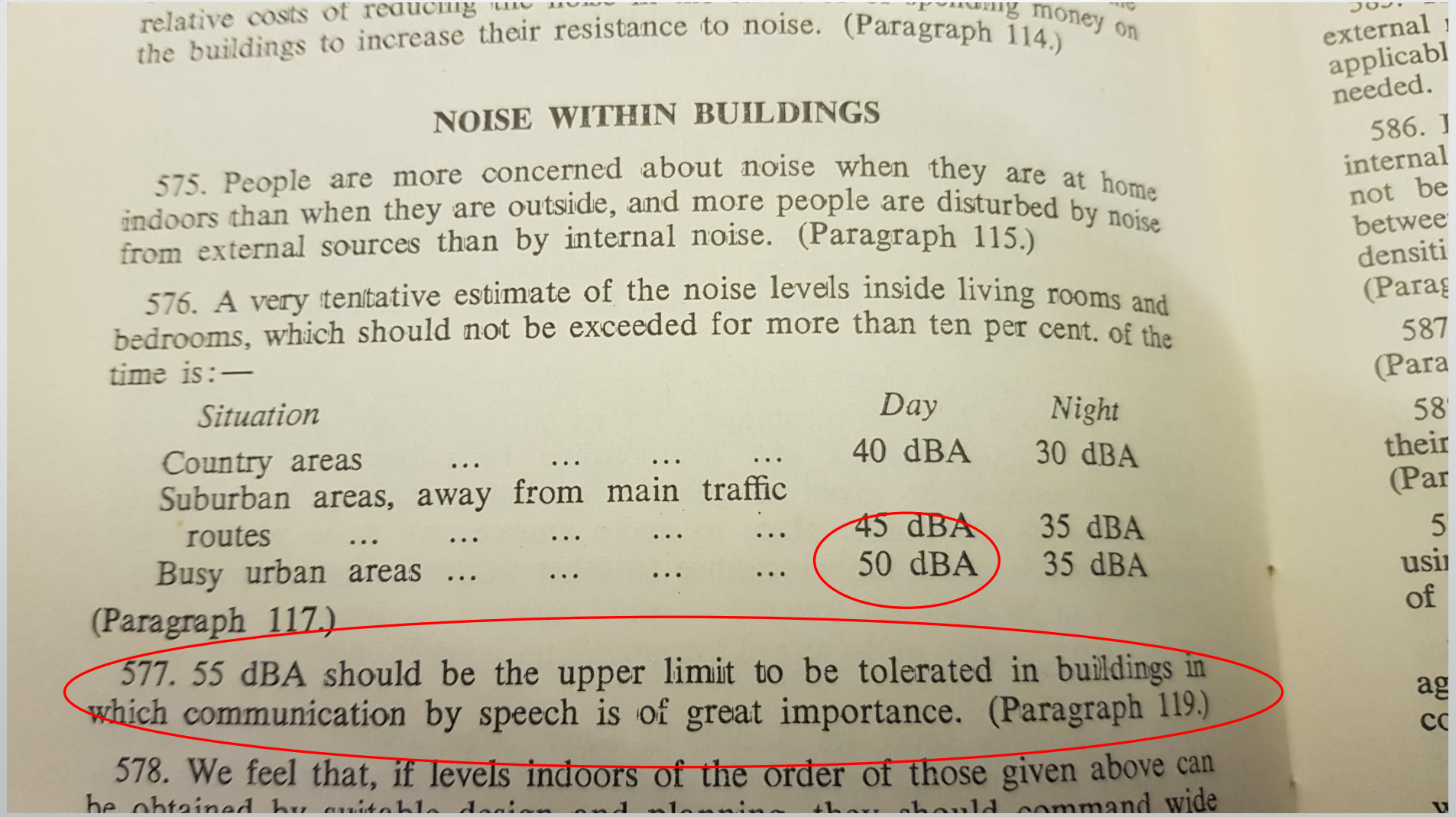
Overheating condition – task interference

- Wilson Report - 1966



Overheating condition – task interference

- Wilson Report - 1966



relative costs of reducing the noise in the ... of spending money on the buildings to increase their resistance to noise. (Paragraph 114.)

NOISE WITHIN BUILDINGS

575. People are more concerned about noise when they are at home indoors than when they are outside, and more people are disturbed by noise from external sources than by internal noise. (Paragraph 115.)

576. A very tentative estimate of the noise levels inside living rooms and bedrooms, which should not be exceeded for more than ten per cent. of the time is:—

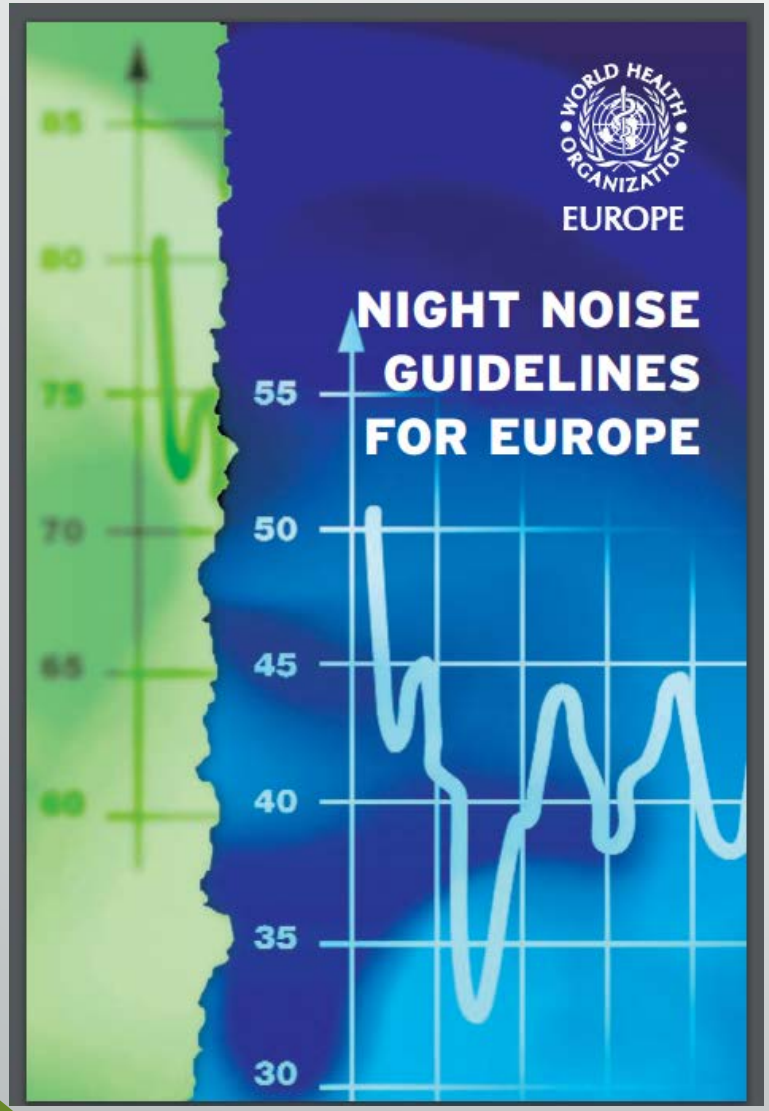
Situation	*Day*	*Night*
Country areas	40 dBA	30 dBA
Suburban areas, away from main traffic routes	45 dBA	35 dBA
Busy urban areas	50 dBA	35 dBA

(Paragraph 117.)

577. 55 dBA should be the upper limit to be tolerated in buildings in which communication by speech is of great importance. (Paragraph 119.)

578. We feel that, if levels indoors of the order of those given above can be obtained by suitable design and planning, they should command wide

Overheating condition – sleep disturbance Leq



- $L_{night,outside}$ > 55 dB "increasingly dangerous for health"
- Open window 13 dB*
- 42dB $L_{night,inside}$

The situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a sizeable proportion of the population is highly annoyed and sleep-disturbed. There is evidence that the risk of cardiovascular disease increases.

* Window(s) open sufficiently to provide a ventilation free area equivalent to 2% of the floor area.

Overheating condition – sleep disturbance noise events

Aircraft noise effects on sleep: Application of the results of a large polysomnographic field study[a)]

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(Received 3 November 2005; accepted 11 February 2006)

Overheating condition – sleep disturbance

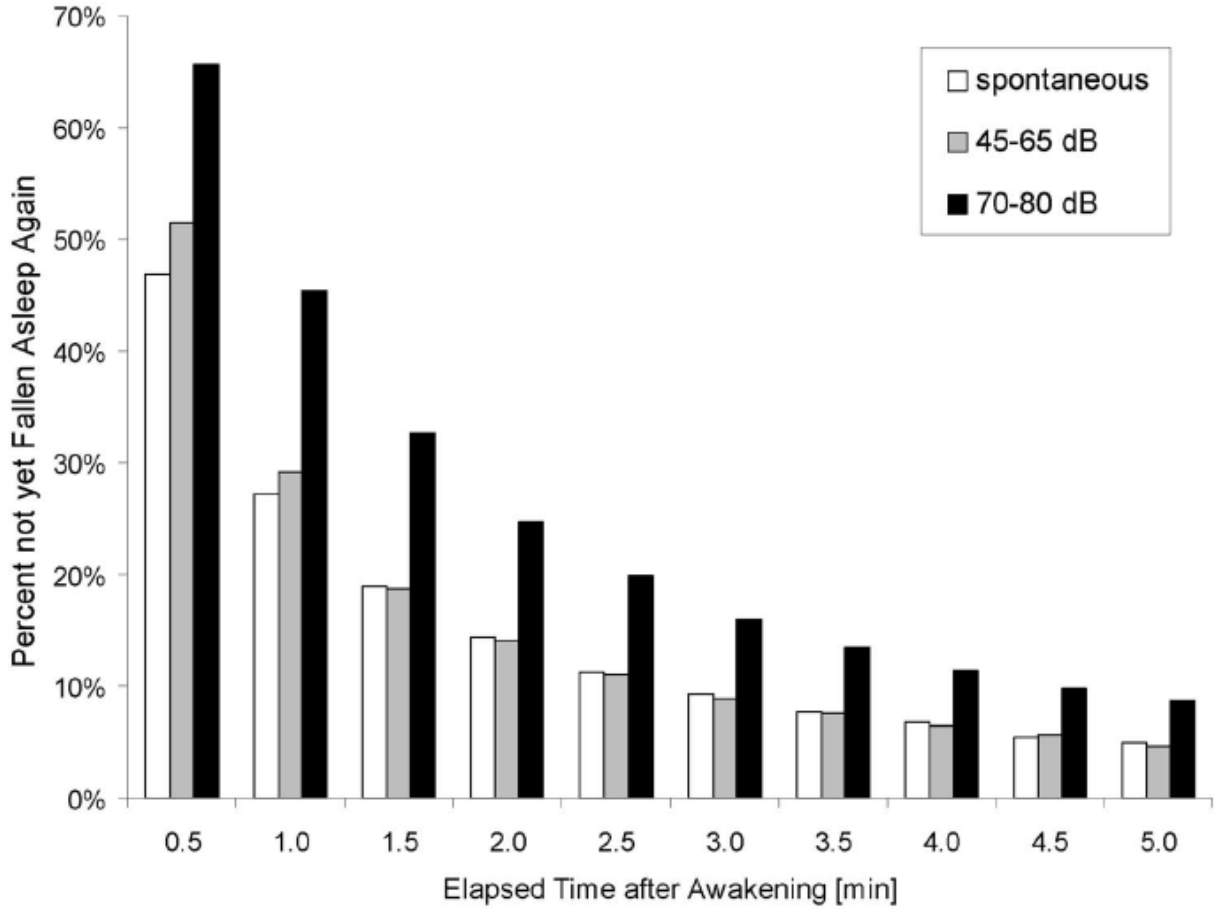


FIG. 3. Duration of noise-induced awakenings compared to spontaneous awakenings. Parameter is maximum SPL.

Overheating condition – sleep disturbance

Awakenings induced by ANEs with maximum SPLs of 65 dB or lower were relatively short. After 1.5 min, descriptively no difference in the percentage of subjects having fallen asleep again compared to spontaneous awakenings was observed. In contrast to that, awakenings induced by ANEs with maximum SPLs of 70 dB or higher were markedly longer than spontaneous awakenings.

Overheating condition – sleep disturbance

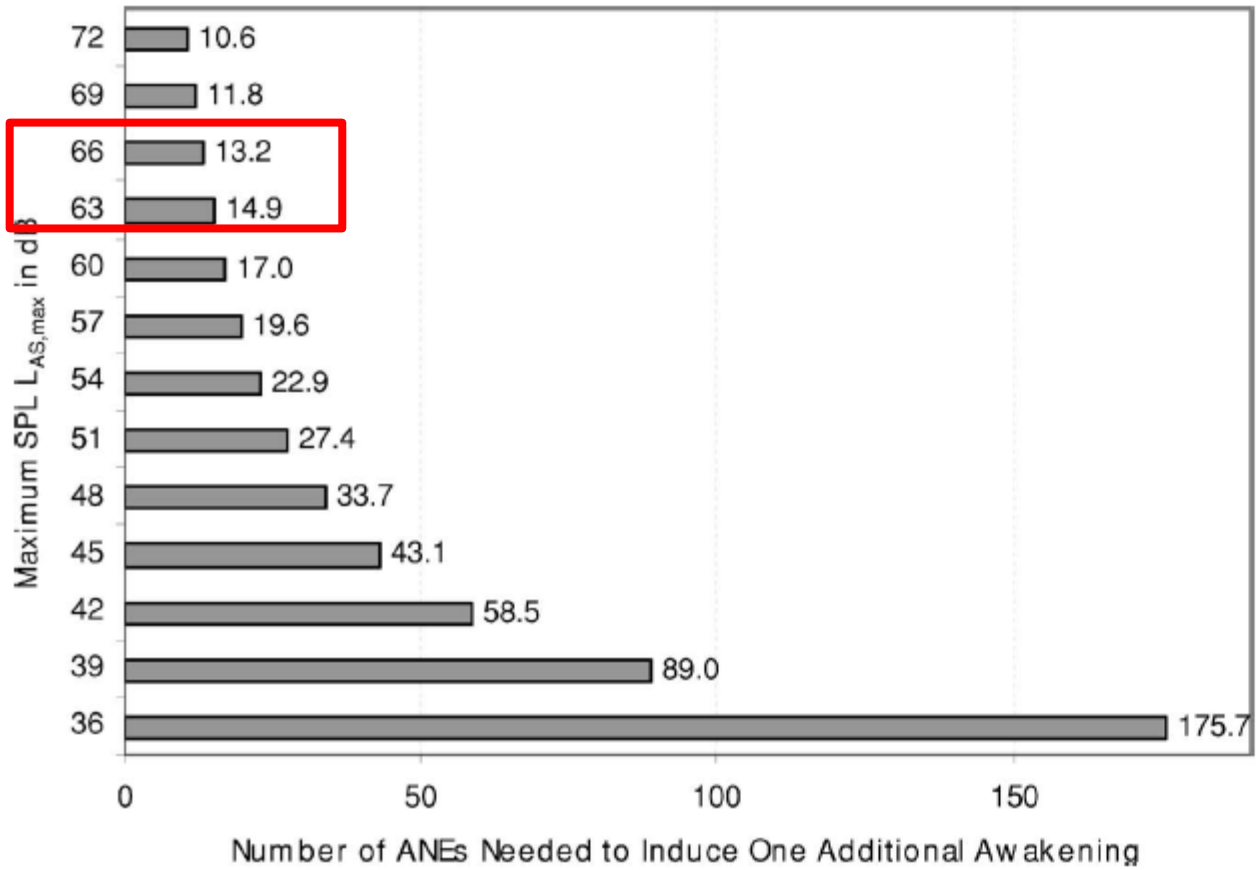


FIG. 4. Number of ANEs needed to induce one additional awakening on average and depending on the maximum SPL. Results are based on the dose-response relationship found in the field study (see Table I).

Table 3-3 Guidance for Level 2 assessment of noise from transport noise sources[Note 1] relating to overheating condition

Internal ambient noise level [Note 2]			Examples of Outcomes [Note 5]	
$L_{Aeq,T}$ [Note 3] during 07:00 – 23:00 [Note 6]	$L_{Aeq,8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 [Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{AF,max}$	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. Having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.
			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. [Note 8]
≤ 35 dB	≤ 30 dB	Do not normally exceed $L_{AF,max}$ 45 dB more than 10 times a night	Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response[Note 9]. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

Note 1 The noise levels suggested in Tables 3-2 and 3-3 assume a steady road traffic noise source but may be adapted for other types of transport.

Overheating condition Guideline noise levels

Daytime – Task interference ≈50dB $L_{Aeq,16h}$

Night tome sleep disturbance ≈42 dB $L_{Aeq,8h}$

Night-time sleep disturbance ≈65 dB $L_{AF,max}$

The values presented in this table **should not be regarded as fixed thresholds and reference can also be made to relevant dose-response relationships** such as those described in a DEFRA 2014 study [15, 21, 22]. With the exception of individual noise events, the references [15,21] are based on evidence drawn from *external* noise levels. There is currently very little robust evidence linking *internal* averaged noise levels with health outcomes and occupant behaviour.

Internal ambient noise levels would normally be considered for living rooms and bedrooms during the daytime. At night, the levels would normally only be applicable to bedrooms.

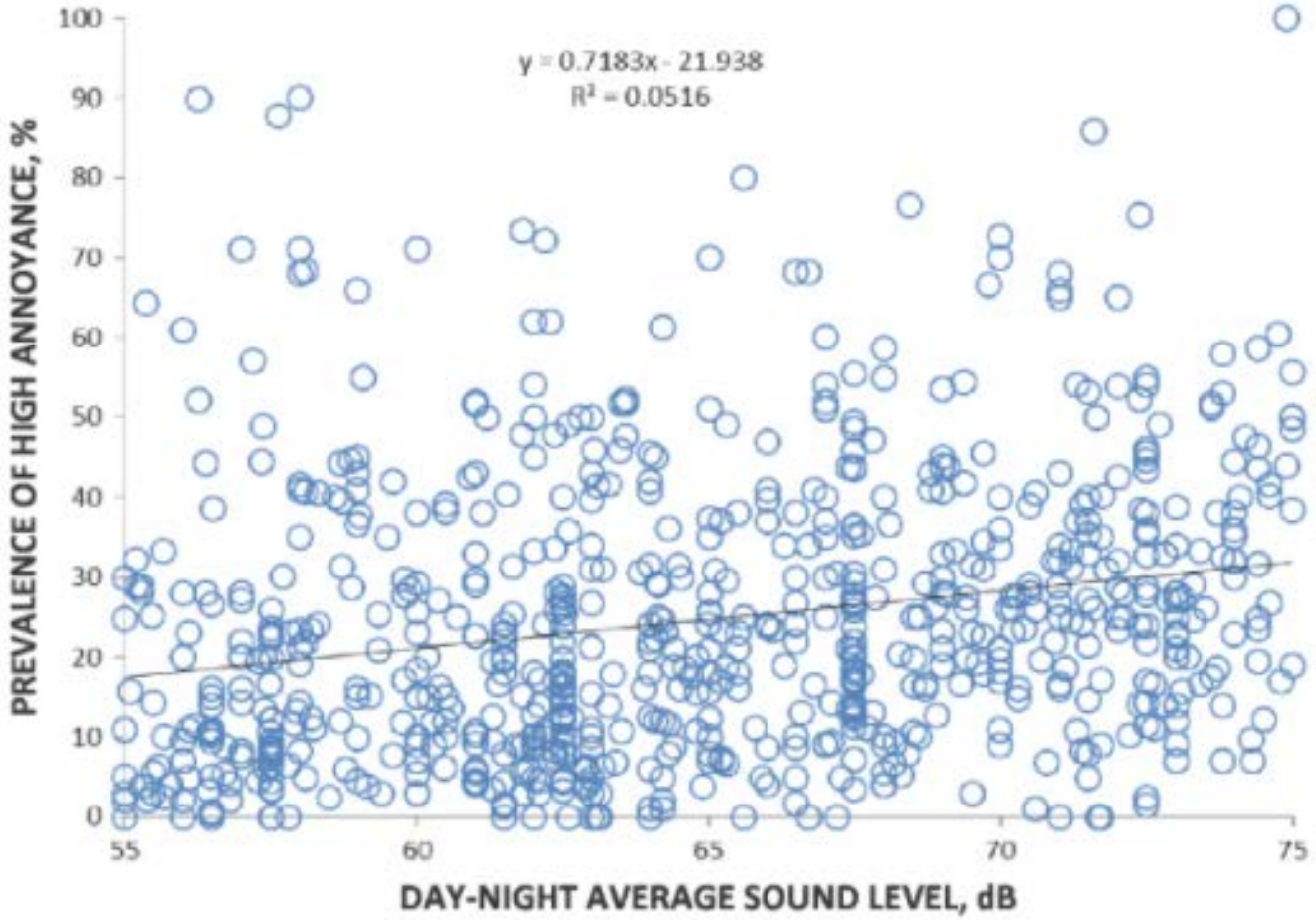
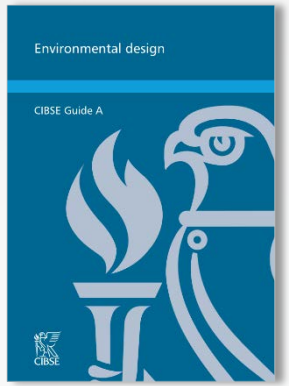


Figure C-2. Poor correlation between exposure and response in exposure range of greatest pragmatic concern.

Mechanical services



	Approved Document F	CIBSE Guide A, Table 1.5		Sound control for homes
Room Type	**dB $L_{Aeq,T}$**	**dB $L_{Aeq,T}$**	**NR**	**dB $L_{Aeq,T}$**
Bedroom	30	30	25	30
Living Room	30	35	30	35
Dining Room				35
Bathroom / WC				45
Kitchen		45-50	40-45	45

Noise from mechanical services - normal ventilation

Figure 3-4 Indoor ambient noise levels from mechanical services - ADF ventilation condition

Ventilation condition	Possible system or design solution	Desirable internal ambient noise levels from mechanical services
ADF – Whole Dwelling Ventilation	System 3: Continuous mechanical extract (MEV), minimum low ventilation rates System 4: Continuous mechanical supply and extract with heat recovery (MVHR), minimum low ventilation rates	Bedrooms ≤ L_{Aeq} 26 or 30 dB [Note 1] Living Rooms ≤ L_{Aeq} 30 dB
ADF – Extract Ventilation	System 1: Intermittent extract fans System 3: Continuous mechanical extract (MEV), minimum high ventilation rates System 4: Continuous mechanical supply and extract with heat recovery (MVHR), minimum high ventilation rates	Bedrooms ≤ L_{Aeq} 26 or 30 dB Living / Dining Rooms ≤ L_{Aeq} 35 dB Bathroom / WC / Kitchen ≤ L_{Aeq} 45 dB
ADF – Purge Ventilation	Manually controlled fan exchanging a minimum 4 air changes per hour	No desirable noise levels are currently proposed based on the lack of evidence of acceptable noise levels when providing purge ventilation for the purpose of rapidly diluting indoor pollutants.

Note 1 A lower level may be more appropriate; refer to paragraph 3.31.

Noise from mechanical services – overheating condition

Figure 3-5 Indoor ambient noise levels from mechanical services - Overheating condition

Possible system or design solution	Desirable upper internal ambient noise levels from mechanical services	
Ventilative cooling or Comfort cooling	Bedrooms	L_{Aeq} 30 (± 5) dB
	Living / Dining Rooms	L_{Aeq} 35 (± 5) dB

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Thank you!

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