



Approved Document O – Measurement of Noise Levels

James Healey, Peninsular Acoustics

Good Practice in Building Acoustic Measurements, Institute of Acoustics

02 March 2024

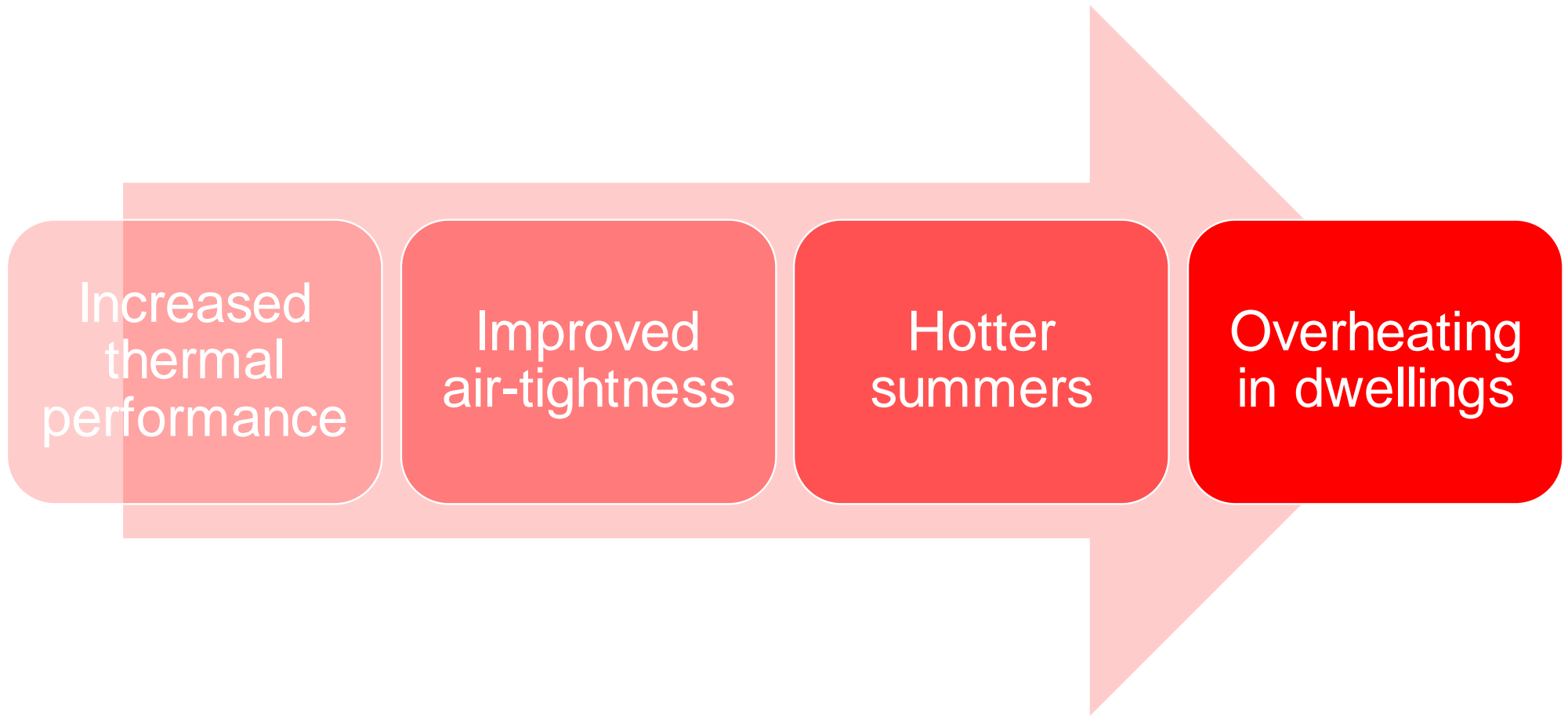


Overheating & Noise

02 March 2024



The Trend





Overheating assessments
assuming open windows

Noise assessments
assuming closed windows



Mismatch



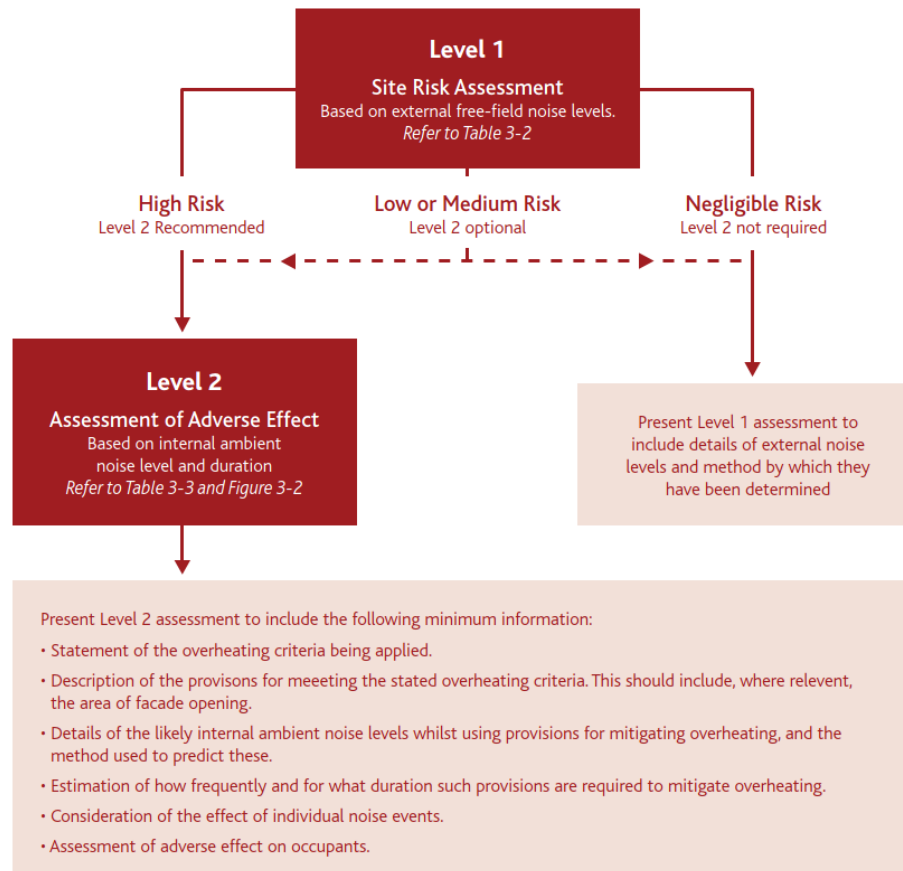
“WE LEAVE THE WINDOWS OPEN UNTIL WE GO TO BED AS THE HIGH LEVEL OF NOISE POLLUTION MEANS WE CAN'T LEAVE THEM OPEN”



“IT GOT SO HOT LAST YEAR THAT THEY HAD TO HAVE THE WINDOWS OPEN WHICH MEANS THAT WHEN THE TRAINS START AT 4AM, YOUR SLEEP IS DISRUPTED WHEN YOU HAVE TO GET UP TO CLOSE THE WINDOW”



AVO Guide





The Building Regulations 2010

Overheating

APPROVED DOCUMENT



Requirement O1: Overheating mitigation
Regulations: 40B

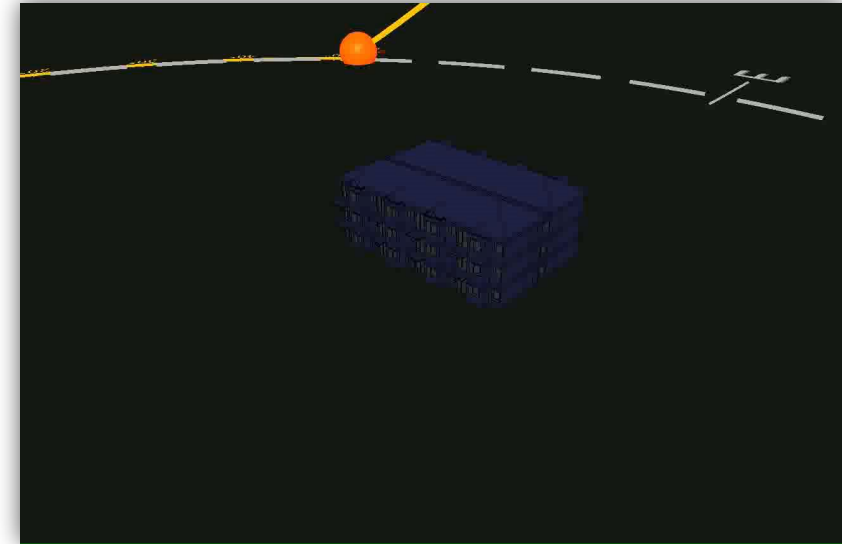
Approved Document O & Noise



Approved Document O

In the Secretary of State's view, compliance with requirement O1 can be demonstrated by using one of the following methods.

- a. The simplified method for limiting solar gains and providing a means of removing excess heat, as set out in Section 1.
- b. The **dynamic thermal modelling** method, as set out in Section 2.

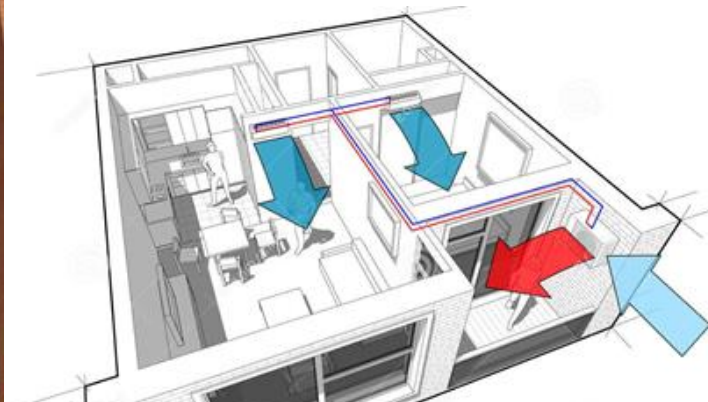




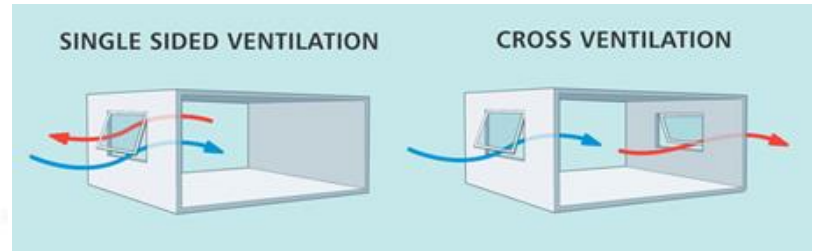
Removing Excess Heat



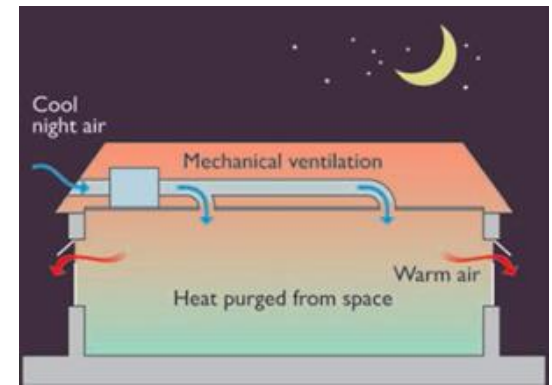
Ventilation Louvres



Mechanical Cooling



Opening Windows




Mechanical Ventilative Cooling



Approved Document O & Noise

Section 3: Ensuring the overheating mitigation strategy is usable

- 
- 3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).
- 3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.
- 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
 - 55dB L_{AFmax} , more than 10 times a night (between 11pm and 7am).
- 3.4 Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' *Measurement of Sound Levels in Buildings* with the overheating mitigation strategy in use.

NOTE: Guidance on reducing the passage of external noise into buildings can be found in the *National Model Design Code: Part 2 – Guidance Notes* (MHCLG, 2021) and the Association of Noise Consultants' *Acoustics, Ventilation and Overheating: Residential Design Guide* (2020).



IoA / ANC Guide to Approved Document O





Noise Guide to ADO



- All sounds except meteorological, animals in domestic settings and water
- Typical night-time
- L_{AFmax} sampling 2-minute duration
- One full 8-hour night
- Introduces Acoustic Open Area
- Thresholds for Simplified Method
- Outline procedure for internal measurements



Assessment of Noise for ADO

02 March 2024

13



Assessment of Noise for ADO

Step 1

- Establish noise constraints

Step 2

- Can Simplified be Used?
Otherwise, Dynamic

Step 3

- Dynamic thermal modelling based on restricted window openings



Assessment of Noise for ADO

What is the sound insulation of an open window?





Assessment of Noise for ADO

What is the sound insulation of an open window?

Table 10 — Sound insulation of typical windows

Description	Weighted sound reduction index R_w dB
Any type of window in a façade when partially open	10–15
Single glazed windows (4 mm glass)	22–30
Thermal insulating units (6-12-6)	33–35
Secondary glazed windows (6-100-6)	35–40
Secondary glazed windows (4-200-4)	40–45

BRITISH STANDARD

BS 8233:1999

Sound insulation and noise reduction for buildings — Code of practice

BS 8128:20

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW





Assessment of Noise for ADC

What is the sound insulation of an open window?



THE BUILDING PERFORMANCE CENTRE
SCHOOL OF THE BUILT ENVIRONMENT
NAPIER UNIVERSITY

NANR116: 'OPEN/CLOSED WINDOW RESEARCH'
SOUND INSULATION THROUGH VENTILATED DOMESTIC
WINDOWS

Submitted to:
Department for Environment,
Food and Rural Affairs
Zone 4/G17, Ashdown House
123 Victoria Street
London SW1E 6DE

April 2007

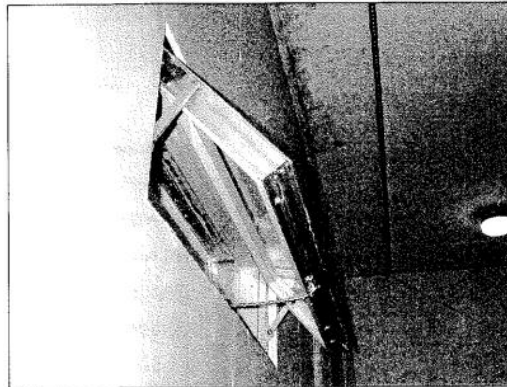
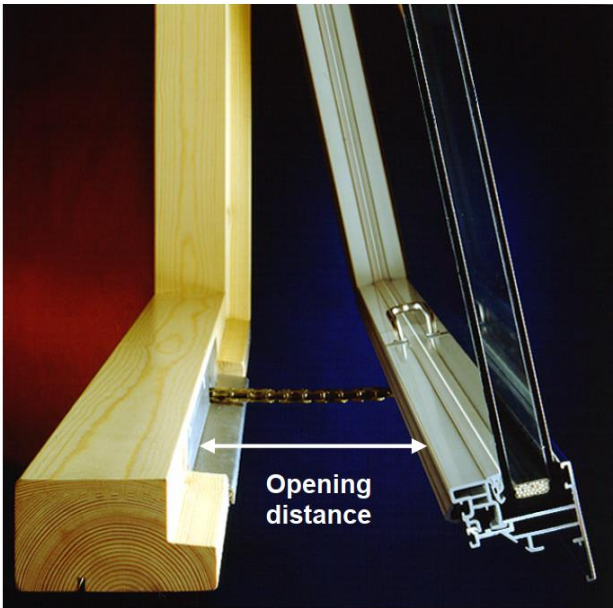
Opening size	Octave Band Centre Frequency (Hz)							$D_{n,e,W} (C;C_{tr})$
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
50k (mm ²)	23	17	19	20	16	21	23	19 (0; -1)
100k (mm ²)	22	16	17	18	15	19	21	18 (-1; -1)
200k (mm ²)	20	14	14	16	14	17	19	16 (0; -1)

Table 5-6. Statistically Derived $D_{n,e}$ insulation ratings for window openings (dB)



Assessment of Noise for ADO

What is the sound insulation of an open window?



Photograph showing Velfac 200 in position 2 opened by 220 mm

Table 4 Test results

Test number	$R_w (C; C_{tr})$ (dB)	$D_{n,e,w} (C; C_{tr})$ (dB)
L104-081	60 (-2;-5)	
L104-081e		60 (-1;-5) *
L104-082f	31 (-2;-6)	
L104-083f	32 (-3;-6)	
L104-084e		29 (-1;-2)
L104-085e		24 (0;0)
L104-086e		23 (0;-1)
L104-087e		22 (-1;-2)
L104-088e		21 (-1;-2)
L104-089e		19 (0;-1)
L104-090e		19 (-1;-1)
L104-091e		18 (0;-1)
L104-092e		17 (0;-1)
L104-093e		16 (0;0)

* This is equivalent to $D_{n,e,F,w}$. $D_{n,e,F}$ is defined in BS EN 20140-10:1992.



Assessment of Noise for ADO

What is the sound insulation of an open window?

The total AcOA is given by the lesser of areas from Eqn 3 or Eqn 4:

$$AcOA \leq w^2 \times \sin(\alpha) + z \times h \quad \text{Eqn 3}$$

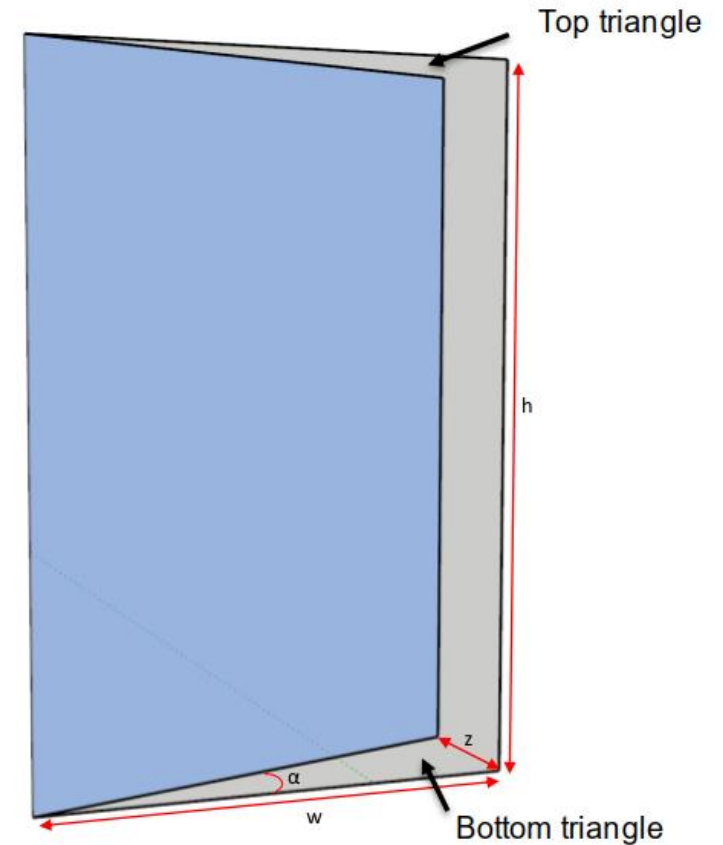
And: $AcOA \leq w \times h \quad \text{Eqn 4}$

BS EN ISO 12354-3:2017

Annex D
(informative)

Sound reduction index of elements

$$D_{n,e} = -10 \lg \left(\frac{S_{\text{open}}}{A_o} \right)$$





Assessment of Noise for ADO

How to measure on site?

- Source Method
- Opening
- Environment
- Procedure



Competency...?





Assessment of Noise for ADO

What if it fails?

What is a fail?

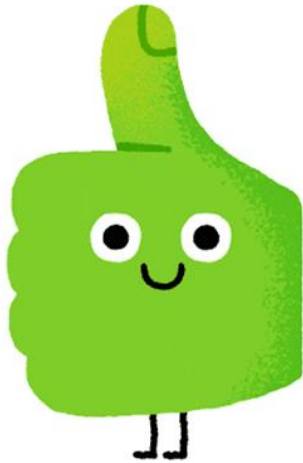
How do you know it's failed?





Assessment of Noise for ADO

Recommendation:
design submission only



- Overheating design submitted at design stage
- Uncertainty on measurement too great



Peninsular
ACOUSTICS

A Measurement Method



A Measurement Method

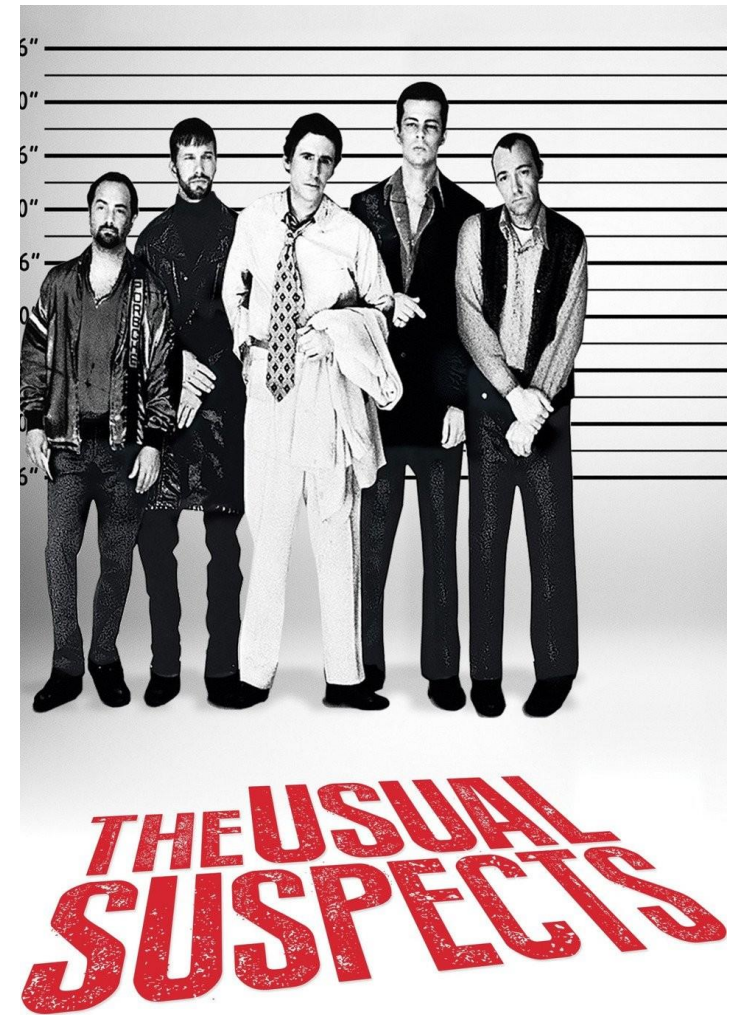
Get familiar with the overheating strategy, inc. window openings (opening length or angle + expected opening windowpane sizes)





A Measurement Method

- Establish outdoor 8-hour conditions
- Remember 2-minute sampling





A Measurement Method

Measure level difference via open window

what are other
words for
at the same time?



simultaneously, concurrently,
nevertheless, nonetheless,
notwithstanding, all the same,
together, still, yet, however



 Thesaurus.plus

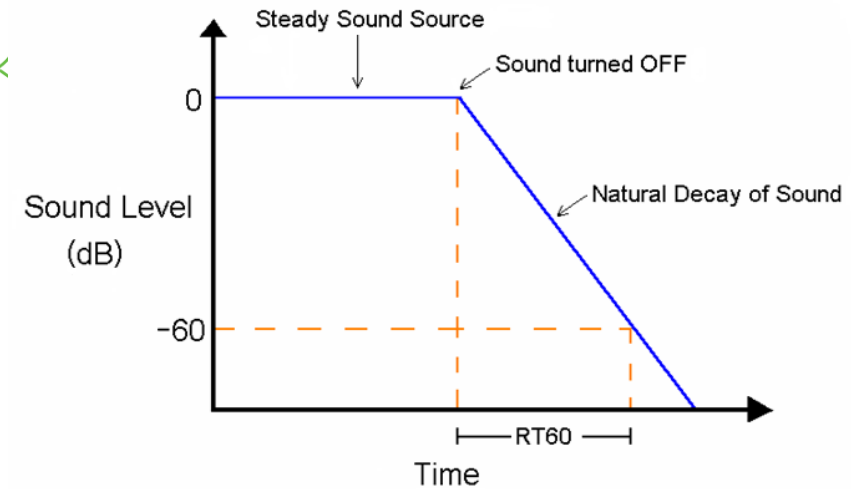
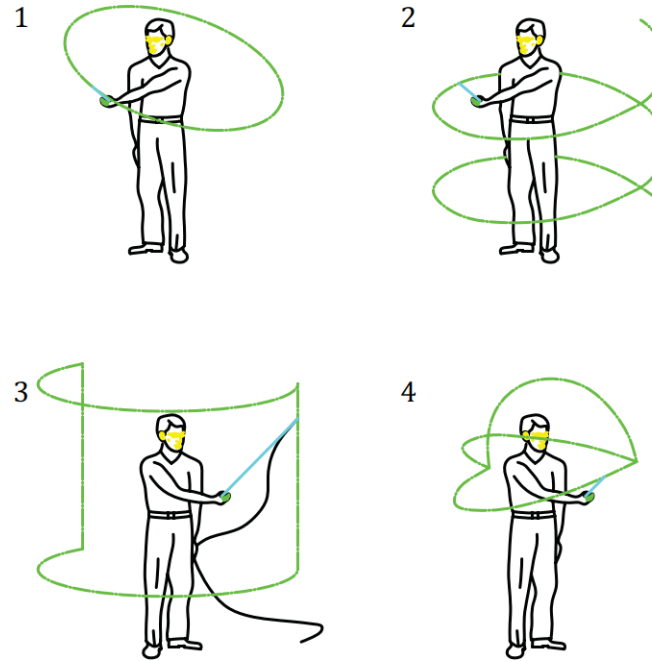
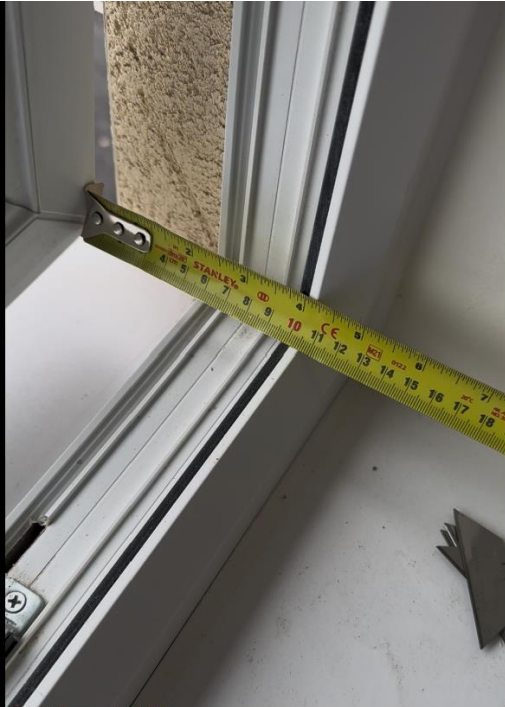


Road traffic source, simultaneous outdoor & indoor, outdoor 1m to 2m from façade, T = min. 50 vehicles



A Measurement Method

Measure level difference via open window



Best using manual scanning technique, measure window or louvre opening extent (example shown) & dimensions, measure room dimensions & RT



Uncertainty

02 March 2024

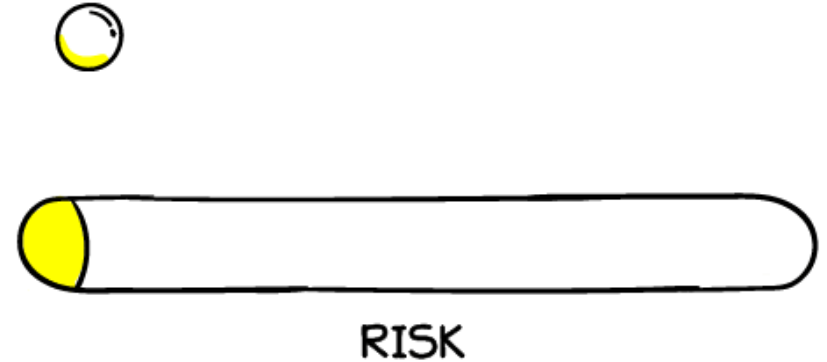
28



Uncertainty

- User procedure
 - Repeatable process
 - Equal conditions to 8-hour night measurement
 - Extraneous events
- Measurement equipment
- Method (16283-3 points to 12999-1 = 1 to 2dB on single figure assuming this applies to partially open windows)

ASSUMPTIONS





Conclusions

- See the IoA / ANC ADO Noise Guide for advice
- Be aware of overheating strategy
- Submission of evidence at design stage recommended
- If having to do measurements, recommended approach:
 - Measure outdoor 8-hour night
 - Measure simultaneous outdoor and indoor using road traffic source
 - Capture suitable room, façade opening and environmental information



Peninsular
ACOUSTICS

Questions?

Setting acoustic standards