Tricky Data
How to identify calculation errors
Practical Guidance

Richard Watson BEng (Hons) CEng MIOA MAES MIEEE

Data gathered onsite then needs to be processed:

For each speaker position:
Log averaging of source measurements,
Log averaging of receiver measurements,
Log averaging of bg measurements.
No rounding in any of this.

Find bg clearance, i.e. difference between receiver level and bg level in each 1/3 octave.

This difference should be rounded to 10dp to avoid floating point errors, which can produce mistakes

1 000 000 000 000 000 - 999 999 999 999 999 =

0

This difference is then used to select the bg correction method needed for this 1/3 octave.

If signal value is 10dB or greater clear of background (i.e. >=10), there is no correction

If the difference in level between the signal value and background value is less than or equal to 6dB (i.e. <=6), then the 1.3dB correction is applied.

All other cases are a log subtraction.
(i.e. >6 and <10)

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The source to receiver difference D can then be found.

Do all this again for any other speaker positions, then arithmetically average all of the D values.

This is then corrected for RT. RT values are averaged but not rounded, and then used to log correct to 0.5 second reference RT.

The only rounding should come at the end in order to present the D_{nT} to 1dp.

Unfavourable deviation (as large as possible, but not more than 32.0dB) shift calculation made.

The $D_{nT,w}$ figure is found and is an integer.

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ANC audits look at a report and data for a given site.

Audits can't see all possible scenarios.

For example, if receiver levels were all 11dB clear of bg, the audit would never find that the tester's sheet might handle bg corrections incorrectly.

The ANC-issued tricky data was created for testers to check that their calculations were working correctly.

Testing all scenarios of receiver levels relative to background (i.e. no correction, log correction, -1.3dB correction)

Testing averaging

Testing 32.0dB calculations

Testing floating point calculations

"This file contains a number of sets of mock airborne test data
Each set of data is intended to test your calculation for a number of key issues.
There are four sets of data for static position testers to use, and four sets of data for sweep testers to use.
In each case, the correctly calculated third octave and overall results are presented, and your calculated values should match these calculated values.
Please note that the data is not intended to simulate real test data, and in many cases would be unacceptable for a real site, however the purpose of the data is to test your calculation method, it is not intended to represent good site data."

Static floating point example:

SP1 5no source

SP1 5no receive

SP2 5no source

SP2 5no receive

1no bg

6no RT

D_{nT} and $D_{nT,w}$ and C_{tr} results given.

Input the raw data given into your calculation method.

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	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1.0 k	1.25 k	1.6 k	2.0 k	2.5 k	3.15 k
	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1.0 k	1.25 k	1.6 k	2.0 k	2.5 k	3.15 k
D1	28.7725	38.9368	39.4732	40.5587	40.5644	43.36927	44.1139	47.4625	49.9903	55.0825	54.882	57.3301	56.9993	55.929	54.8845	51.4688
D2	30.5325	38.5406	35.9494	38.6231	42.2552	41.07086	48.431	48.3201	47.7676	54.9504	53.5324	58.0466	58.6267	55.5479	54.6902	59.0393
D1 D2 dif	1.76	0.3962	3.52377	1.93563	1.69075	2.298417	4.3171	0.8576	2.2227	0.13208	1.34961	0.71655	1.62737	0.38111	0.19428	7.57048
D	29.6525	38.7387	37.7113	39.5909	41.4098	42.22006	46.2725	47.8913	48.879	55.0164	54.2072	57.6884	57.813	55.7385	54.7873	55.254
DnT	31.639	40.9485	39.8064	41.7305	43.5139	44.06698	48.3407	49.7946	50.838	57.8645	56.2394	59.573	59.7628	57.7706	57.049	57.0534
DnT roun	31.6	40.9	39.8	41.7	43.5	44.1	48.3	49.8	50.8	57.9	56.2	59.6	59.8	57.8	57.0	57.1
from test	31.6	40.9	39.8	41.7	43.5	44.1	48.3	49.8	50.8	57.9	56.2	59.6	59.8	57.8	57	57.1
differenc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

D1 is source /bg corrected receiver difference for SP1,

D2 same for SP2,

D is the arithmetic average of these,

D_{nT} has RT correction applied,

Then D_{nT} is rounded to 1dp,

Then compare your result to the given result. 0.0dB

Correct result

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	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1.0 k	1.25 k	1.6 k	2.0 k	2.5 k	3.15 k
D1	28.7725	38.9368	39.4732	40.5587	40.5644	43.82685	44.5715	47.4625	49.9903	55.0825	54.882	57.3301	56.9993	55.929	54.8845	51.4688
D2	30.5325	38.5406	35.9494	38.6231	42.2552	41.07086	48.431	48.3201	47.7676	54.9504	53.5324	58.0466	58.6267	55.5479	54.6902	59.0393
D1 D2 dif	1.76	0.3962	3.52377	1.93563	1.69075	2.755992	3.85952	0.8576	2.2227	0.13208	1.34961	0.71655	1.62737	0.38111	0.19428	7.57048
D	29.6525	38.7387	37.7113	39.5909	41.4098	42.44885	46.5013	47.8913	48.879	55.0164	54.2072	57.6884	57.813	55.7385	54.7873	55.254
DnT	31.639	40.9485	39.8064	41.7305	43.5139	44.29577	48.5695	49.7946	50.838	57.8645	56.2394	59.573	59.7628	57.7706	57.049	57.0534
DnT roun	31.6	40.9	39.8	41.7	43.5	44.3	48.6	49.8	50.8	57.9	56.2	59.6	59.8	57.8	57.0	57.1
from test	31.6	40.9	39.8	41.7	43.5	44.1	48.3	49.8	50.8	57.9	56.2	59.6	59.8	57.8	57	57.1
differenc	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

With the 10dp rounding of the receiver to bg clearance turned off in the sheet, you get two 1/3 octaves now wrong here. If you don't have the 10dp rounding in place to avoid floating point errors, you will have results like this

	315 Hz	400 Hz
R1	53.300000000000000000000000000000	50.100000000000000000000000000000
R1 correct	52.84242509	49.64242509
bg clearance	9.999999999999990000000000000	9.999999999999990000000000000
bg clear range		
bg correction	0.457574906	0.457574906
B1	43.300000000000000000000000000000	40.100000000000000000000000000000

Note receiver to bg difference is actually >=10dB, so no correction should apply. The floating point error has calculated 53.3-43.3 to be 9.9999999, and so the log correction has been incorrectly applied. Log correction is happening, but no correction should be happening.

Each tester is free to (and is encouraged to) check their calculations for all possible errors.

Errors are reducing over time, but common errors are:

floating point (i.e. the computer is finding 50.0-40.0=9.99)

Example 1						Example 2		
B2	L2	Difference			1000 total	Rounded Difference		1000 total
0.0	10.0	10.000000000000000000000000000000	correct		52 correct	10.000000000000000000000000000000	correct	1000 correct
0.1	10.1	10.000000000000000000000000000000	correct		491 less	10.000000000000000000000000000000	correct	0 less
0.2	10.2	10.000000000000000000000000000000	correct		457 more	10.000000000000000000000000000000	correct	0 more
0.3	10.3	10.000000000000000000000000000000	correct			10.000000000000000000000000000000	correct	
0.4	10.4	10.000000000000000000000000000000	correct			10.000000000000000000000000000000	correct	
0.5	10.5	10.000000000000000000000000000000	correct			10.000000000000000000000000000000	correct	
0.6	10.6	10.000000000000000000000000000000	correct			10.000000000000000000000000000000	correct	
0.7	10.7	10.000000000000000000000000000000	correct			10.000000000000000000000000000000	correct	
0.8	10.8	10.000000000000000000000000000000	correct			10.000000000000000000000000000000	correct	
0.9	10.9	10.000000000000000000000000000000	correct			10.000000000000000000000000000000	correct	
1.0	11.0	10.000000000000000000000000000000	correct			10.000000000000000000000000000000	correct	
1.1	11.1	10.000000000000000000000000000000	correct			10.000000000000000000000000000000	correct	
1.2	11.2	10.000000000000000000000000000000	correct			10.000000000000000000000000000000	correct	
1.3	11.3	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
1.4	11.4	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
1.5	11.5	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
1.6	11.6	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
1.7	11.7	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
1.8	11.8	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
1.9	11.9	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
2.0	12.0	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
2.1	12.1	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
2.2	12.2	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
2.3	12.3	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
2.4	12.4	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
2.5	12.5	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
2.6	12.6	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	
2.7	12.7	9.999999999999990000000000000000	less			10.000000000000000000000000000000	correct	

mid-calculation rounding and lack of rounding at the end

B2.1 Sound insulation testing for the purposes of Regulation 41 of the Building Regulations and Regulation 20(1) and (5) of the Approved Inspectors Regulations 2010, must be done in accordance with: BS EN ISO 140-4:1998; BS EN ISO 140- 7:1998; BS EN ISO 717-1:1997; BS EN ISO 717-2:1997; BS EN 20354:1993. When calculating sound insulation test results, no rounding should occur in any calculation until required by the relevant Standards, the BS EN ISO 140 series and the BS EN ISO 717 series.

B3.2 When calculating sound insulation test results, no rounding should occur in any calculation until required by the relevant Standards, i.e. the BS EN ISO 140 series and the BS EN ISO 717 series.

For the statement of the airborne sound insulation between rooms, the values of the normalized level difference D_n, the standardized level difference D_{nT} or the apparent sound reduction index R' shall be given at all frequencies of measurement, to one decimal place, in tabular form and in the form of a curve. Graphs in the test report shall show the value

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lack of care on bg correction switch points:
>10 rather than >=10; <6 rather than <=6.

Receiver	Bg	Difference	Correction
50.0	39.9	10.1	None
50.0	40.0	10.0	None
50.0	40.1	9.9	Log
50.0	43.9	6.1	Log
50.0	44.0	6.0	1.3
50.0	44.1	5.9	1.3
50.0	49.9	0.1	1.3
50.0	50.0	0.0	1.3
50.0	50.1	-0.1	1.3

Input of measurement data to the wrong precision

Measurement precision

B2.18 Sound pressure levels should be measured to 0.1dB precision.

B2.19 Reverberation times should be measured to 0.01s precision.

10 people testing the same structure will generate different results. There will be a range of values that can all be considered “correct” if tested in accordance with the standards.

However, once the data is collected, there should be no additional range in calculated values.

I.e. for the same data, we should all be able to calculate the same results because we are all following the same rules . Any range produced here is error.

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Calculations and results are the responsibility of the tester and any third-party methods must be checked and used with caution.

A +/-0.1dB error in any 1/3 D_{nT} or L'_{nT} has been deemed acceptable by the committee.

Clearly, sometimes a 0.1dB error in a 1/3 octave will lead to 32.0dB becoming 32.1dB, or a 32.1dB result becoming 32.0dB, and the overall result will shift.

It is possible that the 0.1dB allowance reduces in the future, therefore the aim should be precision from all testers.

THANK YOU

Richard Watson

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