It's not just quiet, its COVID quiet...

Last year was a strange time for acousticians. The impact of the COVID-19 virus on noise consultants and regulators alike was mixed...

By Tony Higgins and John Shelton

On the one hand, the lack of road traffic and transport noise led to markedly lower noise levels in the general environment (more of that later). On the other hand, domestic noise complaints, behavioural noise and noise in streets from impromptu parties have been an increased source of complaint as the lockdown generation tried to cope with the new normal. The two observations may be connected – one unmasking the effects of the other?

This article doesn't address the behavioural noise elements but instead, focuses on the broader picture; the changes in transport that have seen markedly lower environmental noise levels and whether assessment of that noise during lockdowns is producing appropriately robust impact assessments.

Those familiar with environmental noise will be aware of a number of key standards in relation to noise and health. The World Health Organization (WHO) guidance (1999 and 2009) provide 'noise limits' based on long-term LAeq levels that provide fixed limits linked to health effects and disturbance. WHO recommends that limits for day time and night time noise should not be exceeded and these are summarised in the table below:

Most environmental noise is mainly influenced by transport activities, in particular road traffic, so let's look at an example of road traffic data pre- and post-COVID.

Traffic noise

Take for example the nation's busiest B road, the B2145 Chichester to Manhood Peninsula road in Sussex. The road supports a diverse mix of traffic that includes many large lorries transporting vegetables, salads and fruit from the greenhouses and fields there. Around 11,000 vehicles per day pass the monitoring point and lorry traffic continues during the night.

The monitoring station logs one second LAeq values, and 1/3 octave spectra, which are uploaded to the web every 15 minutes for archiving, calculations and documentation. The monitoring station has an unobstructed view of (and is 50m from) the road in line with the façade of the receptor.

The monitoring has been going for three years and includes the lockdown cycle last year (2020) so it is interesting to see what effect there might be. P44

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAmax fast [dB]	Source
Outdoor living area	Serious annoyance, daytime and evening. Moderate annoyance, daytime and evening	55 50	16 16	- -	WHO 1999
Outside bedrooms	Sleep disturbance, window open (outdoor values) Lowest Observed Adverse Effect Level (Loael)	45 40	8 8	60	WHO 1999 WHO2009

Calculations of standard parameters are available, but for ease of comparison L_{den} results are shown in the figures below.

The data in Figure 1 (below) provides a summary of the observed measured L_{den} levels. The average measured levels show consistent results as expected for a busy road.

Typically, pre-COVID the L_{den} is between 61 and 63 dB(A) (see 2019 overview) corresponding to an L_{Day} of around 59-61 dB(A) and an L_{Night} of 52-54 dB (see conversion table from research carried out by Brinkla et.al. 2017).

This converted data is then directly comparable to the WHO standards noted above. During 'normal' times the receptor location is clearly subject to high levels of transport noise that exceed the WHO guidelines for both day and night time noise exposure. WHO guidelines would indicate this level of exposure might cause 'critical health impacts', serious annoyance during the day and problems with restful sleep at night.

Below left:
Figure 1:
2019 L_{den} data

Below right:
Figure 2:
2020 L_{den} data

Compare this to the results observed during the lockdown 2020, typically levels of 58-60 dB(A) L_{den}, a reduction of approximately 3 dB, and a corresponding drop in Lday and L_{Night} levels. 3 dB is a noticeable drop in noise levels but might we have expected more?

Studies* indicate drops in LA_{eq} levels from 1.2dB-10.7 dB, but dependent on type of transportation noise.

Results at the monitoring position noted that there continued to be high levels of noise from the road despite lockdown. Observations noted that the number of HGVs continued unchanged, but car numbers reduced significantly. The higher proportion of HGVs as the dominant source conspired to keep receptor noise levels high.

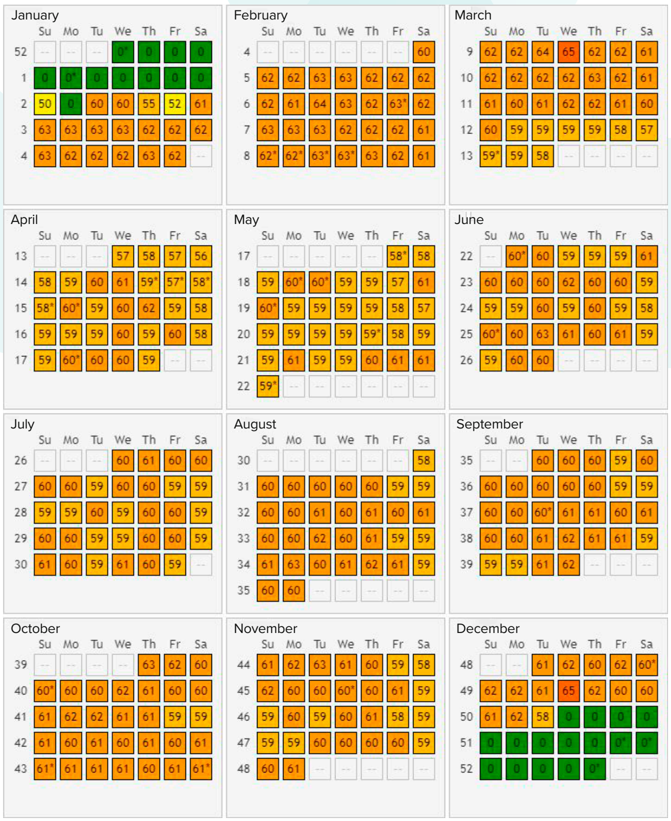
Our data provides a conservative estimate of long-term averages linked to WHO criteria.

Clearly, the 2019 data shows a high level of noise, above WHO levels both before and during the COVID crisis. The reduction due to COVID is significant, but not enough to reduce the overall level of impact despite the perceived level of reduction (the lack of cars on the road).

From an impact assessment perspective, where does this leave the acoustician in terms of context? Obviously, a lower noise level is less harmful, but can we actually say that the impact is now reduced? The presence of higher levels of HGVs no longer masked by increased overall road traffic may actually exacerbate adverse impacts.

So, the case for impact assessment addressing reduction in level from road vehicles may be variable dependent on actual perceived impact, which may or may not be demonstrable from the data. Perhaps looking at transport noise events would better demonstrate impact in these COVID times?

The best example of event noise due to transport is that produced by aircraft. P46



(On 23rd March 2020, lockdown began although traffic had already been reducing prior to that date.)

Assessing the changing urban sound environment during the COVID-19 lockdown period using short-term acoustic measurements; Francesco Aletta, Tin Oberman, Andrew Mitchell, Huan Tong, and Jian Kang May 18, 2020 **https://www.researchgate.net/figure/On-the-left-Sound-levels-distributions-at-the-11-London-locations-for-Location-IDs_fig1_342804275 .**

Aircraft noise

We will take the example the Heathrow. Monitoring was carried out in Windsor between 28th May and 2nd June 2020.

The monitoring station logs one second L_{Aeq} values, and 1/3 octave spectra, which are uploaded to the web every 15 minutes for archiving, calculations and documentation. The monitoring station is located on a flat roof away from other sources of noise, and well above the street level and ambient road traffic (reduced as it was!).

The monitoring provided data in terms of L_{Day}, and L_{Night} for the period in question, and an LA_{max} analysis of events (aircraft noise) in real time.

The tables below provide the data for pre- and post-lockdown noise associated with flights from Heathrow. Flights commenced on 1st June 2020 so the data from 31st May 2020 night and 1st June 2020 day reflect the impact of a return of flying (according to Heathrow data about 60% of capacity).

Start Time (L_{night})	Duration	LA_{eq} (dB)
29/05/2020 23:00:00	08:00:00	46.6
30/05/2020 23:00:00	08:00:00	46.0
31/05/2020 23:00:00	08:00:00	55.0
01/06/2020 23:00:00	08:00:00	42.4

Start Time (L_{day})	Duration	LA_{eq} (dB)
29/05/2020 11:45:41	11:14:19	47.9
30/05/2020 07:00:00	16:00:00	47.9
31/05/2020 07:00:00	16:00:00	48.0
01/06/2020 07:00:00	16:00:00	56.6

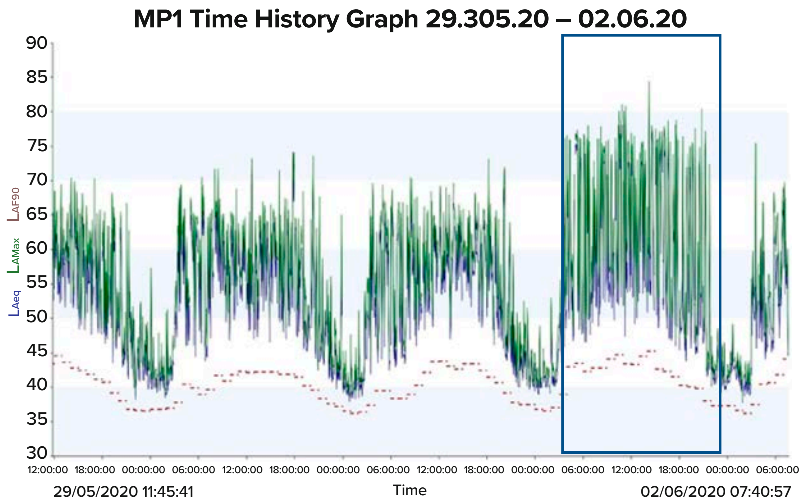
The increase in noise level was significant, a 9-13 dB increase night time noise, and an 8-9 dB increase in day time noise.

This corresponds with the research of Aletta et al**, that reported a maximum increase of up to 21 dB L_{den}.

But, as with the traffic noise example above, long-term levels may not provide the best results for assessment of impact.

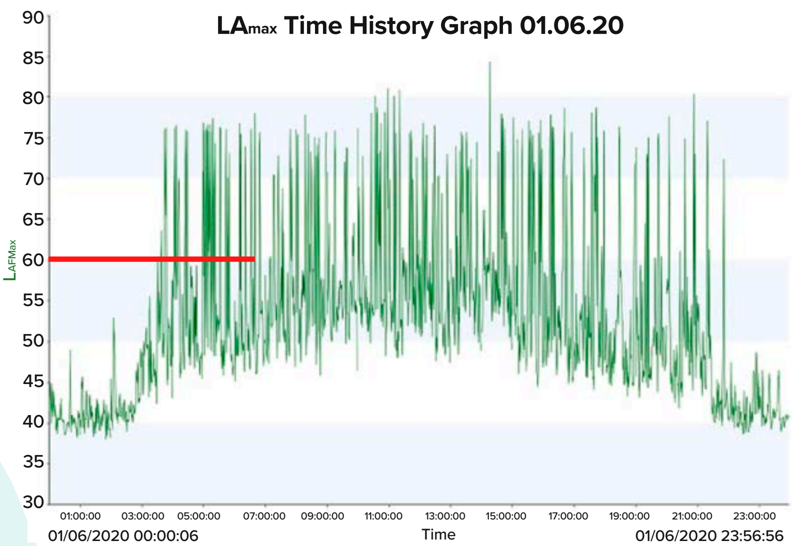
Figures 3, and 4 below show the comparison of L_{max} data for the monitoring period pre- and post-COVID restrictions. Fights recommenced on 1st June 2020.

Below:
Figure 3: Noise data pre- and post-COVID



The data clearly shows a significant increase in number and level of LA_{max} events. Trigger recordings taken also confirm that the events were aircraft-related.

Closer analysis of the results shows the commencement of flights (about 250 of them) and the increase in levels. The red line shows the WHO compliance standard that is broadly complied with without aircraft noise, the graph below shows the level and number of exceedances even from relatively low aircraft activity. P48



** https://www.degruyter.com/view/journals/noise/7/1/article-p123.xml?language=en

Conclusion

So where does all that leave us?

We can't all stop flying and driving, and impact assessments based on monitoring during COVID lockdowns may represent a skewed and unacceptable result in terms of predicting impact. Clearly in some locations, transport noise has historically been high, breaching WHO guidelines, and will no doubt return to those levels when COVID measures are relaxed. The problem for acousticians is not so much how we comply as how we evaluate noise in the current climate. The COVID lockdown processes have clearly affected the ability of acoustic consultants to produce environmental noise reports that assess noise levels 'typical' for the area. In the absence of specific government guidance, the IOA and others issued helpful guidelines to those undertaking measurements, in order to keep development and the economy going, at **https://tinyurl.com/y7qej3mt**

The COVID lockdowns, for all their negative implications, have provided one positive. The lockdowns have shown the impact of transport noise reductions and some of the measures that will be necessary to reduce transport-related noise in order to comply with WHO guidelines.

Noise is recognised by the WHO as second only to air pollution in terms of the adverse impacts on health and wellbeing, COVID has shown us just how far we may need to go (and how much further we may still need to go) to meet the levels where noise does not adversely impact on health.

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Reference table

↓Desired metric↓	↓Known metric↓												
	L_{Day}^{a}	L_{Day}^{b}	L_{Day}^{c}	L_{Night}^{a}	L_{Night}^{b}	$L_{Evening}^{a}$	$L_{Evening}^{b}$	L_{Aeq24h}	L_{den}^{a}	L_{den}^{b}	L_{dn}^{a}	L_{dn}^{b}	L_{dn}^{c}
L_{Day}^{a}		+0.1	-0.5	+7.1	+6.0	+1.6	+2.9	+1.3	-2.0	-2.3	-2.1	-1.8	-1.3
L_{Day}^{b}	-0.1		-0.6	+6.9	+5.9	+1.5	+2.8	+1.2	-2.1	-2.4	-2.2	-1.9	-1.4
L_{Day}^{c}	+0.5	+0.6		+7.6	+6.5	+2.1	+3.4	+1.8	-1.5	-1.8	-1.6	-1.2	-0.8
L_{Night}^{a}	-7.1	-6.9	-7.6		-1.1	-5.5	-4.2	-5.7	-9.1	-9.3	-9.2	-8.8	-8.3
L_{Night}^{b}	-6.0	-5.9	-6.5	+1.1		-4.4	-3.1	-4.7	-8.0	-8.3	-8.1	-7.7	-7.3
$L_{Evening}^{a}$	-1.6	-1.5	-2.1	+5.5	+4.4		+1.3	-0.3	-3.6	-3.9	-3.7	-3.4	-2.9
$L_{Evening}^{b}$	-2.9	-2.8	-3.4	+4.2	+3.1	-1.3		-1.5	-4.9	-5.1	-5.0	-4.6	-4.1
L_{Aeq24h}	-1.3	-1.2	-1.8	+5.7	+4.7	+0.3	+1.5		-3.3	-3.6	-3.4	-3.1	-2.6
L_{den}^{a}	+2.0	+2.1	+1.5	+9.1	+8.0	+3.6	+4.9	+3.3		-0.3	-0.1	+0.3	+0.7
L_{den}^{b}	+2.3	+2.4	+1.8	+9.3	+8.3	+3.9	+5.1	+3.6	+0.3		+0.2	+0.5	+1.0
L_{dn}^{a}	+2.1	+2.2	+1.6	+9.2	+8.1	+3.7	+5.0	+3.4	++o.1	-0.2		+0.3	+0.8
L_{dn}^{b}	+1.8	+1.9	+1.2	+8.8	+7.7	+3.4	+4.6	+3.1	-0.3	-0.5	-0.3		+0.5
L_{dn}^{c}	+1.3	+1.4	+0.8	+8.3	+7.3	+2.9	+4.1	+2.6	-0.7	-1.0	-0.8	-0.5	

References

Conversion between noise exposure indicators L_{eq24h}, L_{Day}, $L_{Evening}$, L_{Night}, L_{dn} and L_{den}:
Principles and practical guidance; Mark Brinka, Beat Schäfferb, Reto Pierenb, Jean Marc Wunderli **https://tinyurl.com/yc59dslw**