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Describing road traffic noise effects on an environmental soundscape.

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1. INTRODUCTION.

Recently the public has been introduced to visual representations of the traffic noise soundscape by the maps produced to comply with the EU Environmental Noise Directive.

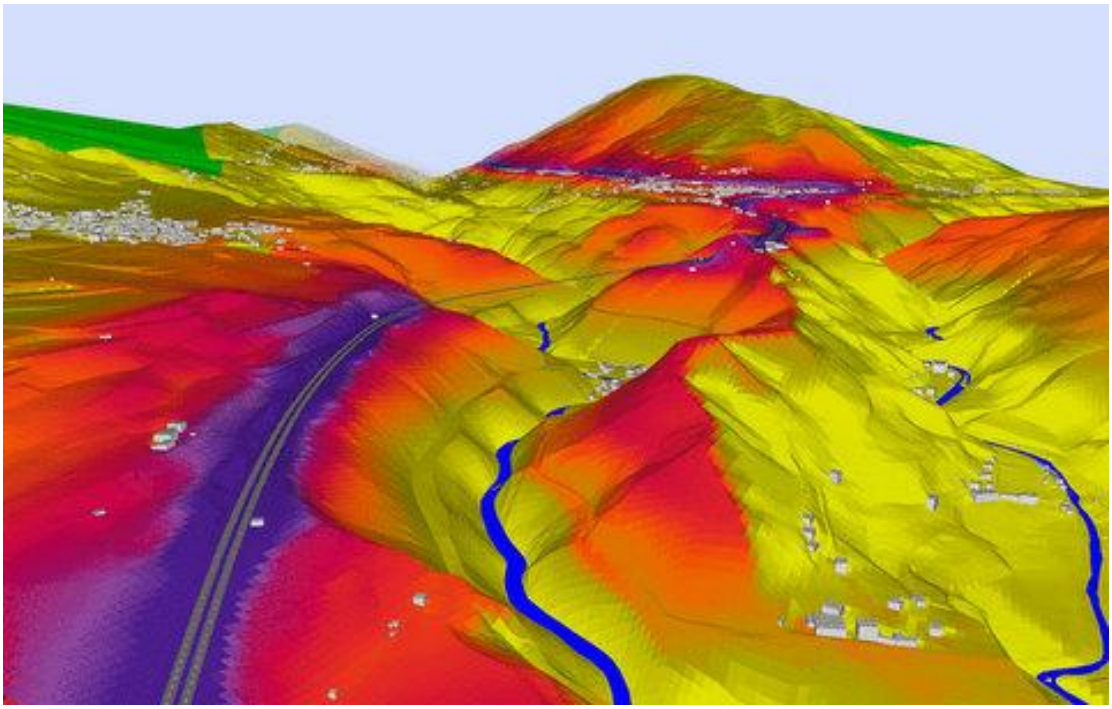

Figure 1. Landscape and soundscape from road traffic..

The coloured areas clearly represent the noise levels over the area with each colour representing a noise band. Using these maps residents in the area can see the road traffic noise level at their premises.

While this information is of interest, it is only valuable to the public if they have a clear understanding of the real meaning of the noise levels and if they accurately represent the effect of road traffic noise on the individual soundscape.

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2. ROAD TRAFFIC NOISE LEVELS

The traffic noise in the maps is expressed as L_{den} levels.:

The day-evening-night level L_{den} in decibels (dB) is defined by the following formula

$$L_{den} = 10\lg\frac{1}{24}\left(12*10^{\frac{L_{day}}{10}} + 4*10^{\frac{L_{evening}+5}{10}} + 8*10^{\frac{L_{night}+10}{10}}\right)$$

The L_{night} level can also be quoted separately to assess sleep disturbance

This formula is derived from the period LAeq levels (12hrs. daytime, 4 hrs. evening and 8 hrs. night) with penalties of 5dB for evening and 10dB for night time levels. The L_{den} is a twenty four hour average.

The period LAeq levels are calculated using annual average traffic flows which makes the final results a 24 hour average of an annual average.

This is appropriate for the purpose intended, namely the EU Environmental Noise directive. This is a strategic planning document which looks at long term changes in the noise climate in order to make action plans to mitigate noise pollution.

Because of the averaging involved in the process, the results are not intended to illustrate the potential annoyance which may be present at a domestic receiver.

3. EFFECTS OF ROAD TRAFFIC NOISE

Receivers are disturbed in different ways by road traffic noise. Close to a busy motorway noise levels may be high but are fairly constant.

The following samples illustrate the differences.

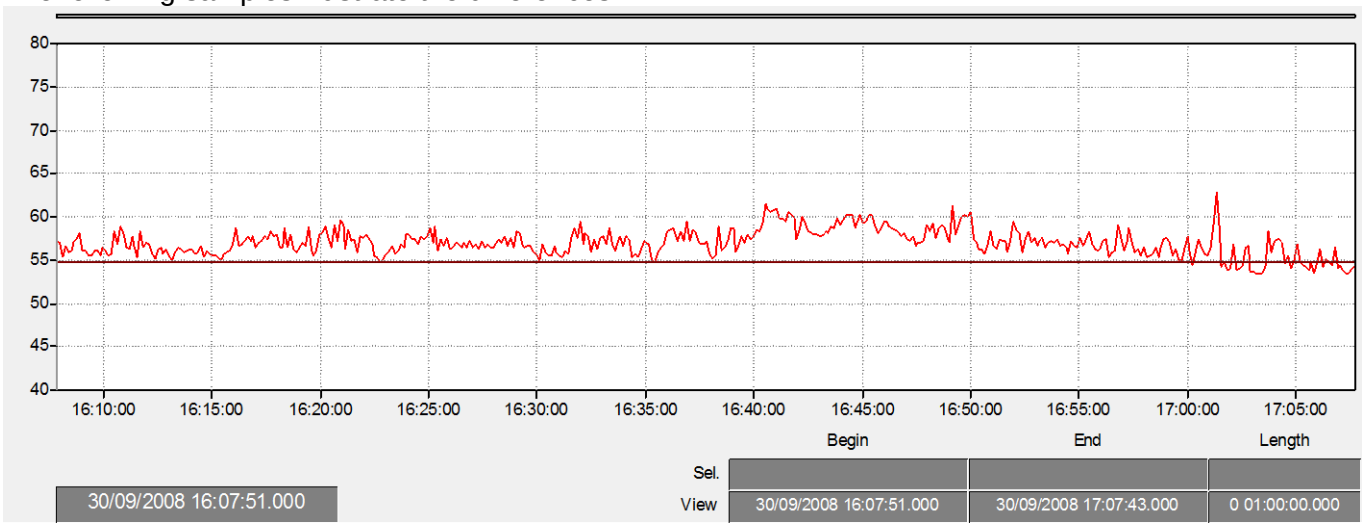

Figure 2 Noise from motorway. 8 second LAeq levels. Period LAeq 57dB

Near side roads, the pattern is different, but the overall LAeq may be the same.

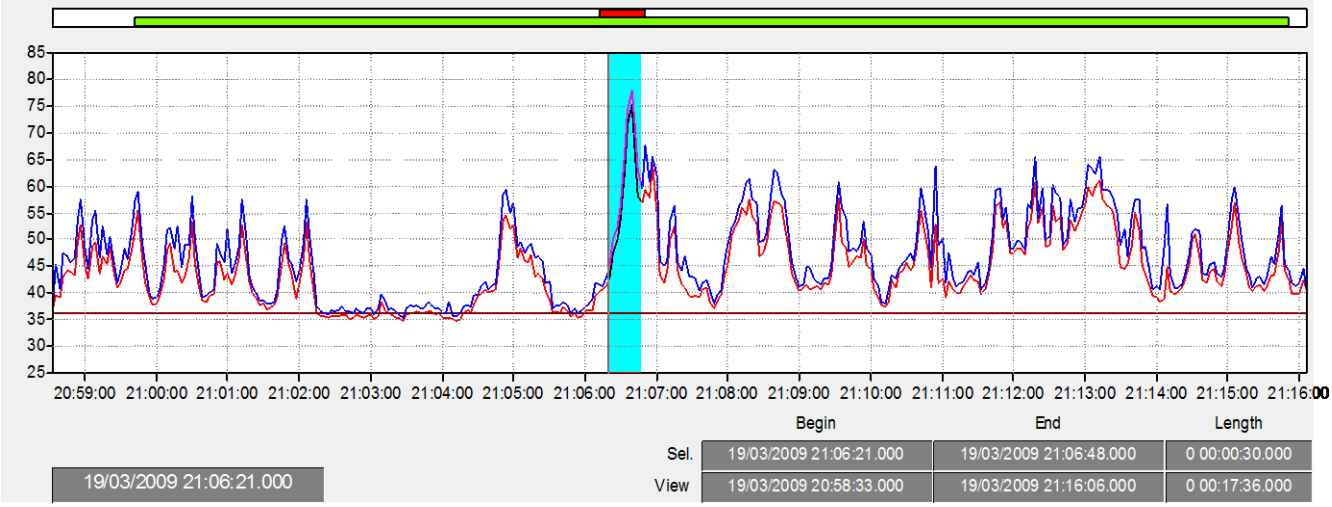

Figure 3 Noise from intermittent traffic on a side road. Highlight, heavy commercial vehicle. Trace shows 1 second LAeq and LA max levels. Period LAeq 57dB.

Figure 3 shows levels around 21:00 hours when the background has dropped to LA 35dB. The vehicle by pass can be LA 40dB higher and represents a much greater noise impact than the continuous noise in Fig 2.

The measurements in Figure 3 were made at the same distance from the road as the façade of the nearest house, but were free field measurements. It can be seen that the highest event of LA77dB from a close commercial vehicle is sufficient to cause sleep disturbance in properties close to the road.

This is probably not the case in the properties close to the location in Figure 2 where highest external levels are just above LA60dB

4. THE USE OF LAeq.

Because the impacts are different and the LAeq can be the same, many experts believe that LAeq is the wrong descriptor for expressing the effects of road traffic noise. Some proposals for using short period Ln and LAmax levels have been discussed.

If we look at figure 3 we can see how these suggestions do not help in defining the impact. The LAmax of LA77dB in Fig3 is significant, but in terms of noise impact we need to know how often the maxima occur and how long the maximum exists in each event.

This brings us back to LAeq levels to express the impact.

Figures 2 and 3 are LAeq levels using a 1 second and an 8 second time base which illustrates that it is possible to express the impact by varying the LAeq time period to suit the noise source.

Very low time periods, such as 1 second, can produce too much data and make analysis difficult. In both the above examples, 1 minute LAeq levels would have reduced the information but would still have been sufficient to illustrate the differences in the effect on receivers.

5. CONCLUSIONS.

It is difficult for the public to understand the new information available on traffic noise affecting their location.

This is partly due to the fact that the criteria used were designed for long term strategic planning.

Different traffic noise data using shorter period LAeq levels would provide better information and a greater understanding of the noise effect on the local soundscape.

I would like to end with the following reference:

> *The specific areas for further research lie in assessing the correct selection of time bases for each individual noise climate and in assessing the subjective level of annoyance relative to given LAeq rating values for each type of environmental noise.*

This is from my M.Sc. thesis written in 1982. Is there anything new in this world?