NoiseMap fi✓e

Creating Noise Contours from Measurements

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2. 'CREATING A NOISE CONTOUR FROM MEASUREMENTS'

INTRODUCTION

We are sometimes asked if NoiseMap can create a noise contour from measured values. In theory, we can use the contouring techniques built into NoiseMap to generate contours from the measured values, but there are factors that make this impracticable in reality. Firstly, it should be appreciated just how many calculation points there are in a noise contour map. The contouring process requires values to be established on a network of points. In NoiseMap, these are usually on a 10-metre square grid, so over a typical 500 metre square tile, there are 2500 calculation points. This would be an unrealistic proposition even if each measurement were only for 10 minutes – that equates to over 400 hours of actual measurement. Even a 50 metre spacing would need 100 measurements – 1,000 minutes or 17 hours, not counting setup, analysis, and so on.

Moreover, variability in traffic flow, wind and other environmental factors will result in spurious variation between adjacent measurements, which is likely to cause distortion in the contour pattern.

In reality, it is more practicable to use a measurement to *validate* a noise model, and this is normally what people have in mind when they talk about creating contours from measurements. The presumption, of course, is that the measurement is correct, whilst the modelled value is 'theoretical'. But measured values can be unreliable for all sorts of reasons such as those mentioned above.

This paper assumes that you want to adjust a noise model so that the predicted noise levels agree more closely with a measured value. Obviously, you will first want to make sure that there are no errors in the model, but also you may have estimated the traffic flows, or there could be other factors such as road surface texture where you have used typical values, whilst the surface may be worn and noisy. If you think it is a surface noise issue, you could try a surface noise adjustment.

But in this example, we are assuming that there is a discrepancy in the traffic flow that we need to correct.

Noise calculates a large number of traffic noise indexes, but usually these are derived from the 18-hour traffic flow, which is used to calculate the L_{A10} (18-hour) noise index. The derivation of the other indexes is done using the TRL/DEFRA method. There is a reference to this method in the Resources section of the NoiseMap website.

We will not describe this method in detail here. Suffice it to say that it gives formulae to calculate the L_{day}, $L_{evening}$, L_{night} and L_{den} from L_{A10} (18-hour) as follows:

For non-motorway roads

$L_{day} = 0.95 \times L_{A10}\ (18h) + 1.44$

$L_{evening} = 0.97 \times L_{A10}\ (18h) - 2.87$

$L_{night} = 0.90 \times L_{A10}\ (18h) + 3.77$

For motorways

$L_{day} = 0.98 \times L_{A10}\ (18h) + 0.09$

$L_{evening} = 0.89 \times L_{A10}\ (18h) + 5.08$

$L_{night} = 0.87 \times L_{A10}\ (18h) + 4.24$

L_{den} is then obtained by weighting and summing the three time periods.

It may be noted that there are methods for converting L_{A10} measured over hourly periods or over the day, evening and night periods, but the conversion for the three parts of the day does have some issues, and we do not recommend it.

CALIBRATION FROM A MEASURED LEVEL

CALIBRATION IN TERMS OF L_{A10} (18-HOUR)

If the difference between the calculated and measured level is δ dB, and the original traffic flow is Q_0 vehicles per 18-hours, then

The required traffic flow, Q_1, can be calculated from the formula:

$Q_1 = Q_0 \times 10^{(\delta/10)}$

For example, if the measured $L_{A10\ (18\ hour)}$ is 1.5 dB above the calculated level, the original modelled traffic flow of 10,000 veh/18-h must be increased to

$Q1 = 10000 \times 10^{0.15} = 14{,}125$ veh/18-h

CALIBRATION IN TERMS OF L_{AEQ} (16-HOUR)

Compared with L_{A10} (18-hour), a slightly greater change in traffic flow is needed to produce a given change in L_{Aeq} (16-hour). This is due to the 16-hour period omitting the early morning and late evening periods.

From the TRL/DEFRA research, the change L_{10} (18-hour) is 1.05 times the change in L_{Aeq} (16-hour).

For example, if we want an increase of 1.5 dB in L_{Aeq} (16-hour), we need a change of

$1.05 \times 1.5 = 1.6$ dB(A) in the L_{10} (18-hour)

Converting this to a change in traffic flow, we have:

$Q_1 = 10000 \times 10^{0.16} = 14{,}454$ veh/18-h

This method of conversion is valid for any value of $L_{Aeq,}$ 16-hour. Other time periods, such as L_{night}, will have slightly different conversion values.

CALIBRATION IN TERMS OF L_{NIGHT}

If we want an increase of 1.5 dB in L_{Night}, we need a change of

$1.11 \times 1.5 = 1.7$ dB(A) in the L_{10} (18-hour)

In the present example, the required traffic flow is

$Q_1 = 10000 \times 10^{0.17} = 14{,}791$ veh/18-h

3. DERIVATION OF CONVERSIONS

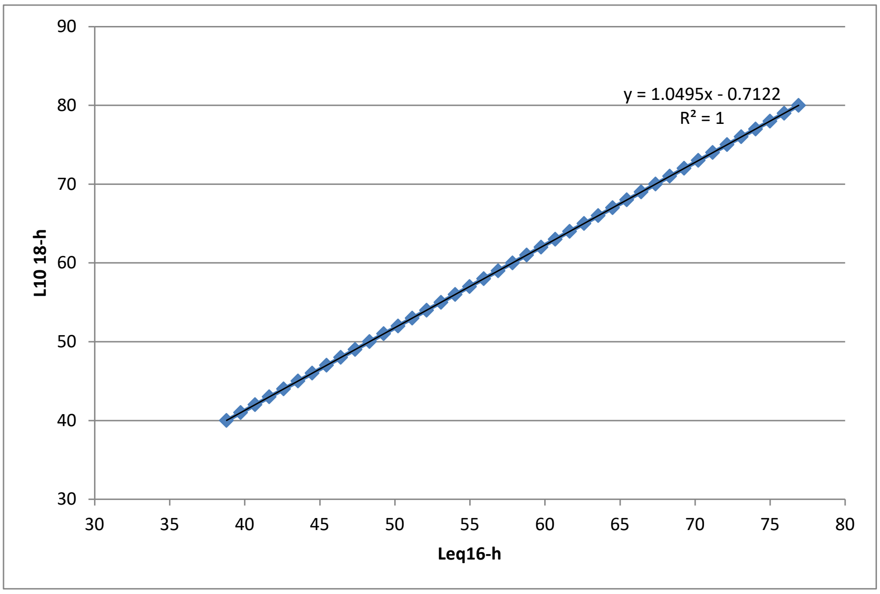
These conversions are presented for non-motorway roads. Motorways have slightly different conversion formulae.

L_{A10} (18-H) TO L_{AEQ} (16-H)

The TRL/DEFRA conversions are only given for L_{day}, $L_{evening}$ and L_{night}. However L_{Aeq} (16h) covers the same period as L_{day} and L_{night} together, in other words it is the time-weighted average of these two values, viz:

L_{Aeq} (16-h) = 10 log(12*10^(L_{day}/10) + 4*10^(Levening/10))/16)

To calibrate the contours, we need to know what change in L10 is needed in order correct the discrepancy in L_{Aeq}. By plotting a chart of this relationship, using the TRL/DEFRA conversion equations described earlier, this can be obtained.



From this, we can see from the regression that the change in **L_{A10} (18-h) is 1.05 times the required change in L_{Aeq} 16-h**.

L_{A10} (18-H) TO L_{NIGHT})

There is no need for any further work to obtain the conversion for L_{A10} (18-h) to L_{night}, as this is already given by the TRL formula:

L_{night} = 0.90 × L_{A10} (18h) + 3.77

Re-arranging: the required change in
L_{A10} (18-h) = 1.11 times the required change in Lnight