Results of the round robin test on noise calculation models for traffic noise

by Martin van den Berg,
Ministry of environment of the Netherlands

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Introduction

A form with 5 standard road traffic noise situations was send to ca 20 national institutions in the noise pollution area. In all 14 usuable forms were collected. Forms used are at the end of the paper. The purpose of this test was to gain insight into the comparability of noise exposure data collected in different countries.
The first results of the round robin test on road-traffic noise calculation schemes are presented here, and analysed for differences. On base of the information supplied some corrections were applied to make results more comparable.
Because of the excellent cooperation, sufficient data was collected of good quality. The results are presented here, together with some analysis to explain the found differences.

results

I picked out every day situations, as regular as possible. Straight, asphalted roads, no reflections, no ramps, curves or obstacles. My expectations of the outcome were that a major part of the calculations would fall within a range of ± 2 dB(A), and a few perhaps outside this range. Furthermore I expected more or less constant differences (so there would be "quiet" and "noisy" methods).
The results however don't show a clear pattern. The spread is much larger, from 6 to 10 dB, with a certain tendency for larger differences for the motorway situation and for the night situation. I present first the raw data, no corrections except for the ones indicated by the authors, as if one would do receiving a condensed report from another country, as often occurs.

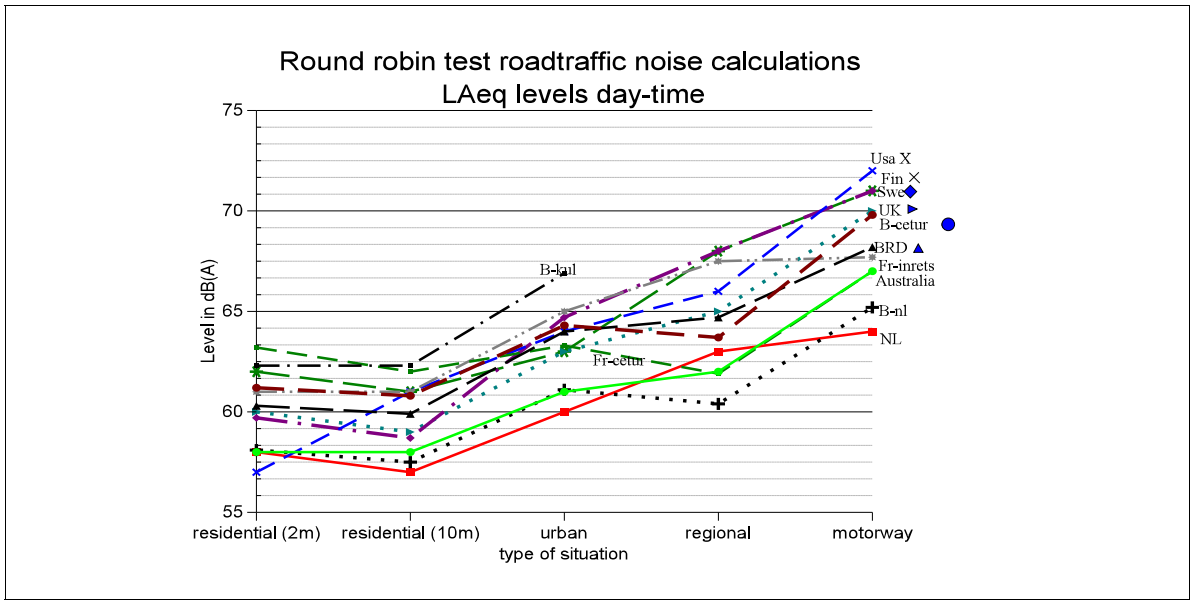
Round Robin test road traffic noise calculations.

DAY	Raw data without corrections other then L10 ---->Leq.				
country(-method)	Residential (2m)	Residential (10m)	urban	regional	motorway
Finland	62	61	63	68	71
UK-EM	60	59	63	65	70
UK-BRE	61	60	65	64	70
Australia	58	58	61	62	67

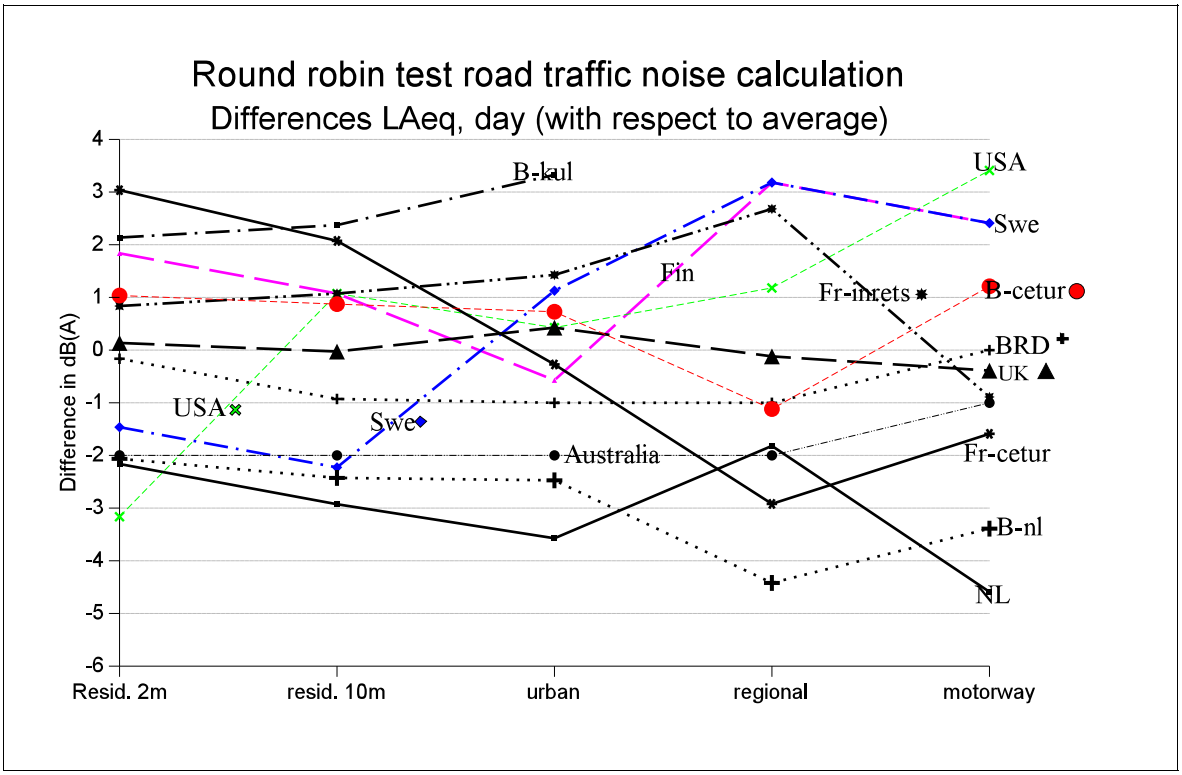
Brd	61	60	65	66	70
Sweden	60	59	66	68	71
Usa	57	61	64	66	72
France-inrets	61	61	65	68	72
France-cetur	66	65	66	65	70
Belgium-cetur	64	64	67	67	73
Belgium-kul	65	65	70	( )	( )
Belgium-dutch	58	58	61	60	65
Netherlands	58	57	60	63	64
MEAN	61	61	64	65	70

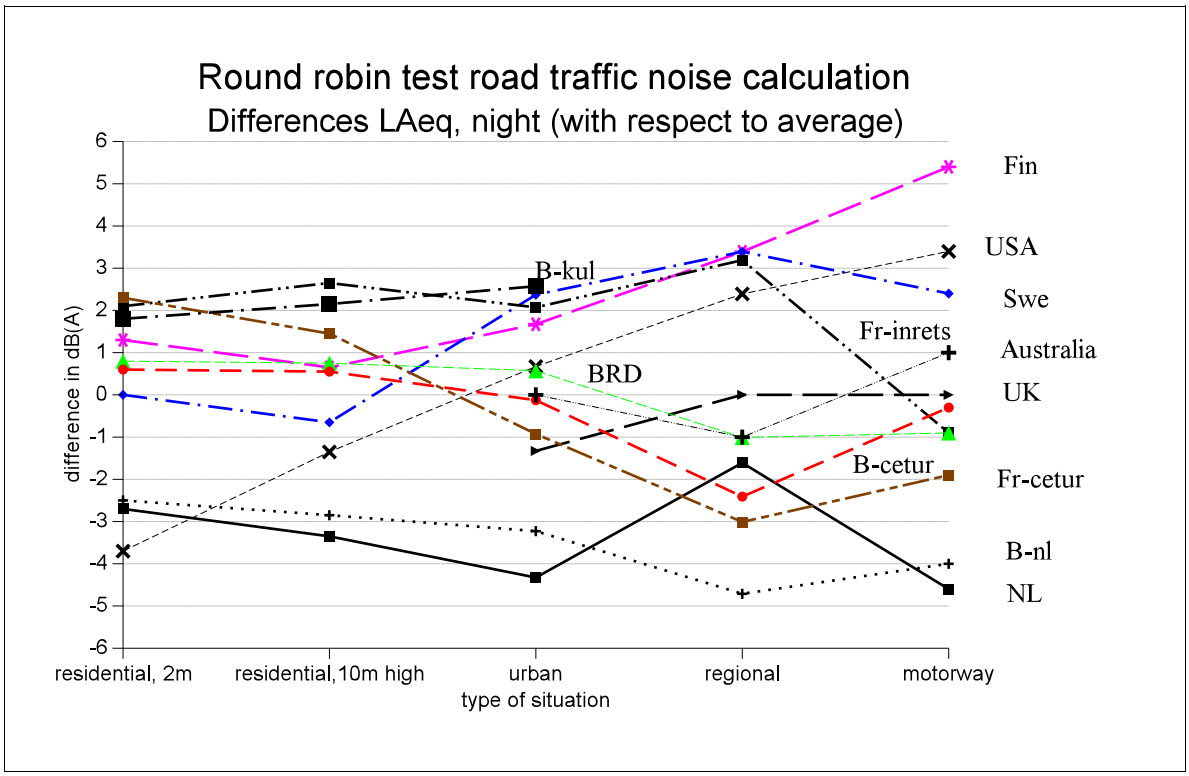
	Raw data Night time				
	Residen tail	Resident ial	urban	regional	motorw ay
Finland	53	52	59	63	67
UK-EM	( )	( )	56	60	63
UK-BRE	( )	( )	56	60	63
Australia	[41]	[41]	57	58	62
Brd	53	52	58	60	62
Sweden	53	52	61	63	64
Usa	48	50	58	62	65
France-inrets	54	54	59	63	65
France-cetur	57	56	59	60	63
Belgium-cetur	55	55	60	60	64
Belgium-Dutch	49	49	54	55	58
Netherlandsl	49	48	53	58	57
Belgium-kul	57	57	63	( )	( )
MEAN	52	51	58	60	63

I included the aritmetic average to calculate differences, because I can make no a priori assumptions as to which outcome is "true".
From the information in the forms, is was possible to make corrections for meteorological conditions, facade reflections, ground absorption and vehicle composition. Except for the facade reflection (taken to be 3 dB), the other corrections are small.
These results are reflected in the next graph, which I will use for further elaborations.



The next graph shows the differences with respect to the mean of all the values:


Round robin test road traffic noise calculation
Differences LAeq, day (with respect to average)
Difference in dB(A)
4
3
2
1
0
-1
-2
-3
-4
-5
-6
Resid. 2m
resid. 10m
urban
regional
motorway
B-kul
USA
Swe
Fin
Fr-inrets
B-cetur
BRD
UK
USA
Swe
Australia
Fr-cetur
B-nl
NL



From these graphs it appears that the order is not the same for the day and the night situation.

causes of differences

Differences (after accounting for principal differences that are known) arise from two main causes:
1) real differences: for the same amount of traffic there is more noise in one country then in another
2) calculation errors: the noise level calculated differs form the actual level because of flaws in the algoritms used.

Actually, there may various sources of real differences (remember that we are talking about situations that give little possibility for variation). I give a few:

- compostion of a mean traffic stream: heavier cars because of different taxation regimes, use of heavier tires (snow!), mean age of car park, preponderancy of one type against another (Italy vs Sweden= FIAT vs VOLVO). Against this hypothesis is that this should give consistent differences between countries. This is not the case.
- driving behaviour may account for differences of 3 dB and more; there is interaction with the

car park (gear shift vs automatics).

- Somewhat more subtle: the standard street layout favours higher levels (eg amount of absorbing surface along the road)
- Circumstances governing ground absorption may be different in different countries; in favour of this hypothesis is the finding that differences increase at larger distance.

Calculation differences may arise from many sources.

- The emission levels were established some time ago and were not updated since
- Emission levels were measured under different circumstances and or speeds and were not properly corrected for;
- Propagation algoritms donot reflect "true" loss. In favour of this hypothesis is that differences seem to increase with distance.

remarks

- Not intentionally, calculations were received made be different institutions with the same method. The outcomes are less different then between methods, but still not negligable (See the "cetur" calculations made by France and Belgium, or Holland and Flemish Belgium, who use the official Dutch method). The 2 UK calculations showed excellent coherence: differences of maximum 2 dB, which can attributed to rounding to integer numbers.
- At the short distances, (up to 50 m) wind and ground effects are small, so there one would expect less differences. Between the highest and lowest result the differences are 6 for the residential situations, and 8-10 for the motorway situations. The difference of 6 dB(A) for the residential area is then entirely due to the emission levels used in the calculation. Are the cars in Holland and USA so much quieter then in Belgium or Finland? Not very likely, although differences may arise because of vehicle weight & type distribution.
- These differences are of the same order of magnitude as the ones Kari Pesonen found in his comparison of calculation methods.
- The difference between cars and "heavy traffic" is in most cases based on weight: the cision varies between 1200 and 3500 kg. The distinction the Dutch method makes in middle and heavy traffic is relatively rare.
- The UK calculates L10, but indicates that the LAeq levels may be calculated by LAeq=L10-3. These values are in the main table. The night levels in the residential area are not calculated because the method states that no reliable results are possible! Something to think about...

conclusions

Before comparing noise levels and standards between countries, one should be aware that large unexplainable differences result when the same situations are calculated with different methods. The differences vary between 6 and 10 dB(A), **after making corrections on the official outcomes**. This means that when a certain standard is chosen, say LAeq=55 dB(A), in Holland 74% (census '93) of the dwellings is under this range when calculated with the Dutch method, but only 15% when calculated with the French Cetur method (without corrections).

The need for a combined effort to establish a common calculation method is obvious. From the data it seems quite impossible to come to a simple translation between methods. The differences lack any

system. The first step would be to isolate real differences from calculation differences. Care should be taken not to make hastily assumptions about acoustic circumstances per country.

More information

M van den Berg
Directorate Noise & Traffic, IPC=635
PoBox 30945
2500 GX Den Haag
Netherlands
tel 31.70.339.4495
fax 31.70.339.1280
Email vandenberg@dgv.dgm.minvrom.nl