

PREVALENCE OF ACCELERATION AT LOW SPEED (≤ 50 KM/H) AND DRIVING AT CONSTANT LOW SPEED (≤ 50 KM/H) AND THE INFLUENCE ON COMMUNITY ANNOYANCE

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Question:

Various international working groups are working on the improvement of the type testing method for vehicle noise. Two modes have been put forward as to be representative for the typical urban driving behaviour:

- a. cruising and/or slow acceleration around 50 km/h typically (so called free flow traffic)
- b. considerable acceleration from 20-50 km/h typically (so called single events)

The question has been put forward, what driving mode is most relevant for the annoyance of citizens. This note presents some information pertaining to this issue.

Information:

The information shows that:

- 1 most annoyance is caused by traffic on ≤ 50 km/h roads;
- 2 most traffic on the ≤ 50 km/h roads will be free flowing or gently accelerating/decelerating, but information on driving behaviour and information on the annoyance caused by accelerating vehicles indicates that acceleration ≤ 50 km/h has an important contribution to annoyance;
- 3 In urban situations (≤ 50 km/h) 'interrupted' flows with traffic accelerating from stand still to free flow speed cause higher annoyance than free flow traffic at comparable LDN levels.

Ad 1:

In 1998 87% of the Dutch population **heard** road traffic noise [1]. About 90% of them especially heard traffic on local (urban) roads with a maximum speed of 50 km/h.

22% of the Dutch population was at least **annoyed** by (urban) road traffic with a maximum speed of 50 km/h (versus 17% in 1993), 8% of the Dutch population was **highly annoyed** by the noise from such roads (7% in 1993).

'Only' 2% of the population was (highly) annoyed by traffic on (country/regional) roads with a maximum speed of 80 km/h (3% in 1993) and also 2% by traffic on highways with a maximum speed of 100-120 km/h (2% in 1993).

Thus in the Netherlands, most noise annoyance is caused by roads with restricted maximum speed (≤ 50 km/h). It is supposed that this result will not significantly differ in other European countries.

Ad 2:

The proportion free flowing versus accelerating traffic on ≤ 50 km/h roads is not known in general. However, it is known that 37% of the Dutch population which was annoyed by road traffic noise, especially was annoyed by accelerating or decelerating traffic [2].

In another study with respondents living along ≤ 50 km/h roads in two Dutch cities (focussed on ‘special’ vehicles among which (diesel driven) light delivery vans and taxi’s), it was found that acceleration is the most (35% at least moderately and 12% highly annoyed), or one of the most annoying (25% at least moderately and 6% highly annoyed) sources of the noise emission [3].

Unfortunately ‘normal’ private cars were not the object in this study.

The prevalence of accelerations can also be derived from a French study among more than 1000 drivers, in which the following distribution of different driving styles has been found (see table 1) [4].

Table 1. Typology of car drivers in France

Quiet, disciplined and fuel saving drivers	26%
Rather quiet and slightly fuel saving drivers	23%
Fast and anticipating drivers	23%
Sportive and no fuel saving drivers	15%
Aggressive and obtrusive drivers	8%
Others	5%

Although recent information on driving styles in other European countries is missing, there are no reasons to expect that this distribution of behaviour substantially will differ between these countries. Table 1 indicates that a substantial proportion of the car drivers (23%) can be considered as ‘sportive’ or ‘aggressive’ drivers.

Ad 3:

In the framework of this note an analysis has been performed on basis of the large, international TNO dataset on exposure – response relationships for transportation noise [5]. For this analyses the **urban** arterial roads are selected. They are distinguished in road parts with a **free** traffic flow and road parts with a crossing with another equivalent road less than 150 meter from the dwelling of the respondent, or where on this distance traffic lights are functioning, causing an ‘interrupted’ flow, i.e. a flow with **accelerating/decelerating** traffic.

Table 2 shows results, based on 10 studies in urban situations with a total number of 5089 respondents (see [6]).

The respondents were exposed to LDN levels between 45 and 75 dB(A). It has to be remarked that this noise exposure refers to total traffic flows (e.g. in LDN over 24 hours), and do not represent the noise emission from a single car.

Table 2 shows a difference between interrupted and free flow related high annoyance of about 11%, but the relevancy of this percentage is restricted, since the noise exposure (LDN) also differ between these type of flows and the exposure of the individual respondents is left out of consideration here.

However, **corrected for the noise exposure**, the **difference in high** annoyance between interrupted and free flows appears to be significant ($p = .000$): **6%**.

Table 2. Annoyance due to free flowing and interrupted traffic flows

	Number respondents	Mean annoyance (0-100)	% highly annoyed	Exposure LDN dB(A)
Free flowing traffic	3251	51.5	27.6	65.5
'Interrupted'/accelerating traffic	1838	57.3	38.4	68.9
Total	5089	53.6	31.5	66.7

The conclusion is that in urban situations 'interrupted' traffic flows with traffic accelerating from stand still to free flow speed are more annoying than free traffic flows with the same LDN. Another conclusion is that the results suggest a different dose-effect relationship for accelerating and free flowing traffic. However, more research is needed to confirm this suggestion.

References:

- [1] Jong RG de, Steenbekkers JHM en Vos H. Hinder en andere zelf-gerapporteerde effecten van milieuverontreiniging in Nederland. Inventarisatie verstoringen 1998 (annoyance and other self-reported effects of environmental pollution in the Netherlands). TNO-rapport PG/VGZ/2000.012. Leiden, 2000.
- [2] Jong RG de, Opmeer CHJM en Miedema HME. Hinder door milieuverontreiniging in Nederland (annoyance by environmental pollution in the Netherlands). TNO-PG nr 94.056. Leiden, november 1994.
- [3] Dongen JEF van. Hinder door bijzondere voertuigen in stedelijke gebieden. (Annoyance by special vehicles in urban areas). TNO-PG rapport 97.002. Leiden, 1997.
- [4] Labiale G. Survey on driver behaviour. In: Rothengatter T en R. de Bruin, eds. Road User Behaviour, theory and research. Assen/Maastricht: Van Gorcum, 1988: pp 255-259.
- [5] Miedema HME, Vos H. Exposure-response relationships for transportation noise. Artikel in J.Acoust.Soc. Am. 104 (6), december 1998, blz 3432-3445
- [6] List of studies concerned:
 AUSTRIA-329: 5-Area Tyrol Traffic Noise Survey (1989)
 FRANCE-092: French Ten-City Traffic Noise Survey (1973)
 FRANCE-239: French Combined Aircraft/Road Traffic Survey (1984-1986)
 GERMANY-192: German Road/Railway Noise Comparison Study (1977-1983)
 JAPAN-369: Kumamoto Road Traffic Survey (1996)
 THE NETHERLANDS-276: Netherlands Tram and Road Traffic Noise Survey (1983)
 SWITZERLAND-173: Zurich Time-of-Day Survey (1978)
 UNITED KINGDOM-071: B.R.S. London Traffic Noise Survey (1972)
 UNITED KINGDOM-072: English Road Traffic Survey (1972)
 UNITED KINGDOM-157: London Area Panel Survey (1977)