Journal of Sound and Vibration (1997) **205**(4), 513–516

MAXIMUM NOISE LEVELS IN CITY TRAFFIC

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(*Received* 3 *March* 1997)

Manual and automatic noise measurements were made along 13 streets in Gothenburg, Sweden to explore sources of maximum noise levels. Noise from different types of vehicles driven in a realistic way in inner city traffic was measured. In summary, the result show that the most important vehicle component as regards the maximum noise level in inner city traffic was a medium-weight truck (delivery truck). Among the higher noise levels measured (>80 dB(A)), this type of vehicle is dominant. This is supported by tests that demonstrated that the noise level of a light truck, driven in a realistic way, exceeds that of cars and is on the same level as heavy trucks. Measures can be taken against the noisiest vehicle types specifically, and the noise load can be limited by introducing noise bans for particular streets in which vehicles that emit greater than a certain noise level would not be allowed use of the street.

1. BACKGROUND

Disturbance caused by noise is one of the most important environmental health consequences of the transport apparatus. Over a number of years, investigations in different countries have shown that noise affects different activities and causes sleep disturbance and a poorer life quality [1–3]. There is thus a great need to control noise caused by transport.

Investigations of the relationship between exposure to noise originating from different vehicles in the transport apparatus and effects among the exposed population form an important basis for technical measures to limit noise generation and to regulate noise levels. Such investigations have studied the extent of annoyance among persons exposed to different types and levels of environmental noise. As regards noise exposure, some studies have suggested that the noise level and number of vehicles be treated as independent variables instead of counting them into a single index. The most extensive database available is for aircraft noise [4–6]. Results of these investigations have shown that the optimal way to express noise exposure is to describe it as the number of events over a certain noise level (70 dBA) and the maximum noise level that occurs three to five times per a 24-hour period. The number of events is important for the extent of annoyance, but only up to a certain point, after which a further increase in the number of events does not lead to a further increase in the extent of annoyance. Within each interval of the number of events, the extent of annoyance is determined by the maximum noise level.

This dose–response principle has also been evaluated in investigations of other types of environmental noise, and the results support its general applicability [4–8].

The present study was performed to determine the sources of maximum noise levels in city traffic and involved manual measurements of the highest noise levels along 13 different streets in Gothenburg in reference to vehicle type. Measurements were also made of the

0022–460X/97/340513 + 04 $25.00/0/sv971019

noise levels of three different types of vehicles, driven under realistic and controlled conditions at different speeds and in different gears.

2. MATERIAL AND METHODS

Manual measurements of noise levels were made in 13 areas in Gothenburg. The measurements were performed by one person for a period of one hour. The measurements were made during non-rush hours, at some time between 10:00 and 15:00, using a microphone on a stand at a level of 1·5 m above the ground. The maximum level was read manually on a Brüel & Kjær noise level analyzer in the position dB(A)FAST. The distance to the nearest driving lane was 2·5 m. The measurement person simultaneously classified the type of vehicle under one of the following classes: motorcycle, private car, delivery van ($<3{\cdot}5$ ton), medium-weight truck, heavy-weight truck and bus. For some calculations, the vehicles were divided into light vehicles (motorcycle, private car, delivery van) and heavy vehicles (medium-weight truck, heavy-weight truck and bus).

Measurements were made of the maximum noise level from three types of vehicles driven under controlled conditions at an old airfield. A car (Volvo 245-1991), a medium-weight truck (Ford Cargo 0813) and a heavy truck with a trailer (Volvo FH520) were driven in different manners and at different speeds. The trucks were not loaded.

The vehicles were driven past a microphone (Brüel & Kjær, model 4165) placed in a free field at a height of 1·5 meters and a distance of 5 and 7·5 meters from the right side of the vehicles. The maximum noise level in dB(A) with the time constant FAST was measured with a noise level analyzer (Brüel & Kjær, model 4426) when driving at different speeds in different gears past the measuring point. Measurements were also made when the vehicles were driven at maximum acceleration in each gear. When evaluating the results, particular emphasis was placed on the maximum noise level of 75 dB(A). This level has been previously suggested as a guideline for road traffic noise [8].

3. RESULTS

The results from the measurements show that, of 950 measured events, approximately 6% of the vehicles exceeded 70 dB(A) and less than 1% exceeded 75 dB(A) maximum noise level.

Table 1 reports the proportion of different vehicles that emitted a maximum noise level below and above 75 dB(A). The data show that medium-weight trucks had the highest proportion of vehicles emitting more than 75 dB(A).

The results of measurements made of a car driven at high speed in different gears are shown in Figure 1. The figure shows that driving in low gear at a high speed caused a high

TABLE 1

Maximum noise levels from passenger cars (C), *vans* (V), *medium-weight trucks* (MWT), *buses* (B) *and heavy-weight trucks* (HWT)

Type	C		V		MWT		B		HWT	
dB(A)	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
<75	120	94	35	97	27	54	23	88	14	93
$\geqslant 75$	7	6	1	3	23	46	3	12	3	7

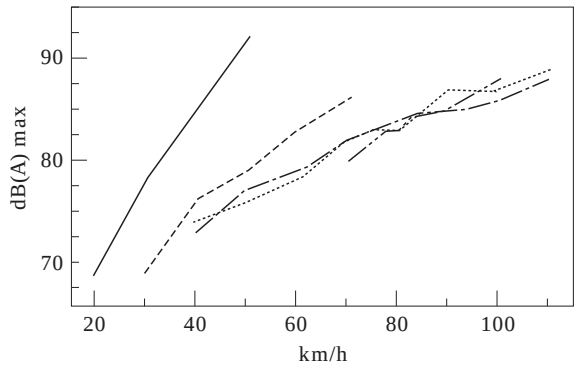

Figure 1. Noise level of a car driven at high speed in different gears. Gears: ———, 1st; – – –, 2nd; — · —, 3rd; ····, 4th; — · · —, 5th.

noise level. The noise increase was less marked when the car was driven at high speed in a higher gear owing to the dominant noise from the tires and the road.

Figure 2 presents a comparison of noise levels from a car and a medium-weight truck driven at normal speed. It can be seen in the figure that the medium-weight truck was about 10 dB noisier at speeds of 40–50 km/hour.

Figure 3 shows maximum noise level from the medium-weight truck compared with a heavy-weight truck (Volvo FH520). It can be seen that the smaller truck was somewhat more noisy at low speeds (+5 dB at 15 km/h).

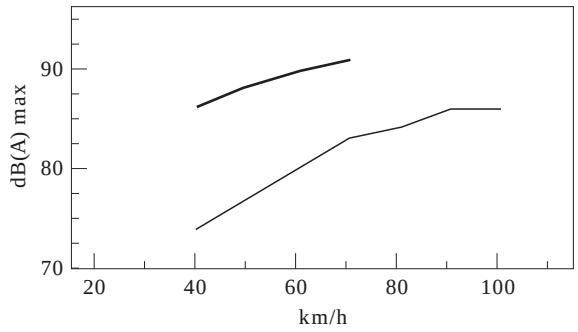

Figure 2. Noise levels emitted by a car and a medium-weight truck at normal speed in different gears at a distance of 3 m. ——, Truck; ———, car.

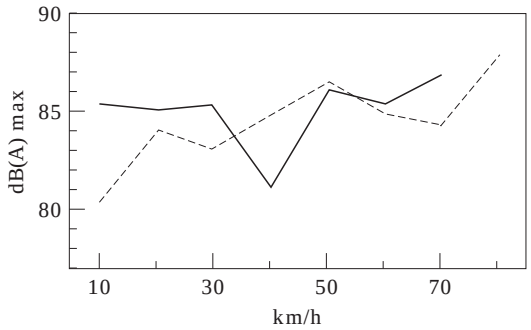

Figure 3. Maximum noise levels for a medium-weight truck versus a heavy-weight truck. ———, Medium; – – – –, heavy.

5. COMMENTS

The study was based on relatively few measurements, and the results cannot be interpreted as representative for city traffic in general. Making the measurements manually, however, increased the precision of the description of the maximum noise levels as well as of the type of vehicle.

The results show that relatively few vehicles emitted high maximum noise levels. It has previously been suggested that 75 dB(A) max should be the guideline value for environmental noise-induced annoyance [8]. Only 1% of the vehicles exceeded this value. This suggests that important improvements in city traffic noise situation could be achieved by focusing attention on a relatively low number of vehicles.

The origin of the maximum noise levels was mainly medium-weight trucks and only seldom passenger cars or heavy trucks. This may be due to an aggressive driving behaviour in low gears or insufficient noise reduction. Age and maintenance may also play a role. If the results of the present study are generally applicable, improvements in the noise situation should thus be directed mainly towards these vehicles and should be emphasized on better driving disciplines, improved noise control and/or maintenance.

Although medium-weight trucks caused the highest maximum levels, cars are capable of emitting similar noise levels when driven at high speeds in a low gear.

In summary, the results show that medium-weight trucks are an important source of high maximum noise levels in city traffic. The results further suggest that it is feasible to remedy the environmental discomfort caused by city traffic with rather limited actions towards particularly noisy vehicles.

ACKNOWLEDGMENT

The study was funded by the Swedish Transport and Communications Research Board [95-453-24].

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