On the annoyance caused by magnetic levitation train passby sounds

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In the laboratory study, the annoyance caused by the passby sounds from a magnetic levitation (maglev) train was investigated. The listeners were presented with various sound fragments. The task of the listeners was to respond after each presentation to the question: "How annoying would you find the sound in the preceding period if you were exposed to it at home on a regular basis?" The independent variations were a) the driving speed of the maglev train (varying from 100 to 400 km/h), b) the outdoor A weighted sound exposure level (ASEL) of the passbys (varying from 65 to 90 dB), and c) the simulated outdoor to indoor reduction in sound level (windows open or windows closed). As references to the passby sounds from the maglev train (type Transrapid 08), sounds from road traffic (passenger cars and trucks) and more conventional railway (intercity trains) were included for rating too. Four important results were obtained. Provided that the outdoor ASEL's were the same, 1) the annoyance was independent of the driving speed of he maglev train was considerably higher than that caused by the intercity train, 3) the annoyance caused by the maglev train was hardly different from that caused by road traffic, and 4) the results 1) – 3) held the true both for open or closed windows. On the basis of the present results, it might be expected that the sounds are equally annoying if the ASELs of the maglev-train passbys are at least 5 dB lower than those of the intercity train passbys. Consequently, the results of the present experiment do not support application of a railway bonus to the maglev-train sounds.

1. INTRODUCTION

Magnetic levitation (maglev) trains utilize an advanced technology in which magnetic forces lift, propel, and guide the vehicle over a guide way. The technology permits maximum speeds of up to about 500 km/h, which is almost twice as high as that of conventional high-speed trains. Because of its high speed, the maglev train is able to compete with auto and aviation modes for travel distances between about 75 and 1000 km, and is therefore an interesting travel option for the 21st century.

Test tracks of the maglev train have been built in Japan, Germany and China. In the USA there are currently no maglev systems in operation, although there are several corridors that have been studied in detail and that are awaiting funding decision by the Federal Railroad Administration.1 For some of these projects environmental impact statements are being prepared.

Similarly, in the interest of improving the infrastructure of the Northern part of The Netherlands, an intelligent choice among various alternative measures required detailed knowledge about the *annoyance* caused by the passby sounds from a maglev train. Since at least in Europe, there are at present no tracks of the maglev train located in or close to residential areas, a field survey could not be carried out. Consequently, the research was performed in the laboratory.

Some data on the overall loudness (rather than annoyance) of passby sounds of a maglev train (type Transrapid 07) and more conventional trains (types EC, IC, ICE, and a freight train) have been reported by Fastl and Gottschling (1996) and by Gottschling and Fastl (1997). In these two related laboratory studies, the overall (or global) loudness ratings for the maglev and more conventional train sounds presented at comparable A-weighted equivalent sound levels were not significantly different.

In a laboratory study reported by Neugebauer and Ortscheid (1997), the overall loudness and other subjective evaluations were determined for passages of a maglev train and a conventional short-range train. For three relevant factors (evaluation, activity, and potency) summarizing the responses obtained with the method of the semantic differential, the sounds of the maglev train yielded significantly higher values than those of the short-range train, indicating that overall, the subjects were more negative about the maglev train. Moreover, especially at the higher A-weighted equivalent sound levels, the sounds from the maglev train were considerably louder than those of the short-range train.

Results on a semantic study of acoustic and non-acoustic aspects in the evaluation of maglev and short-range train passby sounds have also been reported by Quehl (1999). The limited number of experimental conditions and imperfections in a portion of the passby sounds, however, prevented her from drawing firm conclusions.

In sum, the available data on the subjective evaluation of maglev-train sounds are limited, and the results are inconsistent. The results described in Fastl and Gottschling (1996) and in Gottschling and Fastl (1997) suggest that the railway bonus for conventional trains might also be applied to the maglev train, whereas the results from Neugebauer and Ortscheid (1997) might indicate that application of the bonus to the maglev train is not permitted.

In the present laboratory study, listeners had to rate the annoyance of various sound fragments. With respect to the validity of the experimental results obtained in laboratory studies, our experiences are positive. For example, differences in annoyance between road-traffic sounds and shooting sounds produced by small firearms, as found in field surveys, are obtained in laboratory studies also (Vos, 1995).

One of the independent variables in the present study was the driving speed of the maglev train (varying from 100 to 400 km/h). Since most environmental noise ordinances are based on sound levels measured outside residences, the second independent variable was the outdoor A-weighted sound exposure level (ASEL) of the passbys (varying from 65 to 90 dB). The annoyance inside the dwelling furthermore depends on the attenuation of the façade structure. As a result, the third independent variable was the simulated outdoor-to-indoor reduction in sound level (windows open or windows closed). As references to the sounds from the maglev train (type Transrapid 08), sounds from road traffic (passenger cars and trucks) and more conventional railways (intercity trains) were included for rating also.

2. METHODS

A. SOUND FRAGMENTS

The stimuli were sound passages of a maglev train, various intercity trains, a high-speed train, and various passenger cars and trucks. For all passages, free-field digital recordings were made.

The sounds of the maglev train (type Transrapid 08) were recorded in Lathen, Germany (de Graaff et al., 2001). We selected passages at four driving speeds (100, 200, 325 and 400 km/h), each passage being simultaneously recorded at three distances of 25, 50 and 100 m. From these 12 recordings, 16 different sound fragments were prepared. Each fragment consisted of one passage with a duration of 15-20 s. Since the total duration of all fragments included in the present study was fixed at 45 s, the maglev-train passages were preceded and followed by silent periods of about 12-15 s. A realistic presentation of the fragments requires that, given a specific distance between the source and the receiver the sound level at which a passage is reproduced in the laboratory does not significantly deviate from the level found in the field. A satisfactory representativeness could be obtained for all sound fragments.

The fragments of the intercity trains were based on the sounds from passenger trains (types ICR/ICM and IRM?DD) recorded at distances of 35 and 100 m. The driving speed of the various trains was estimated to range between 120 and 140 km/h. Again, each fragment consisted of one passage. The duration of a passage was equal to 25-30s

The fragments of the high-speed train (type TGV-Atlantic) were based on passages recorded at distances of 50 and 200 m. The driving speed of the train was equal to about 300 km/h.

The fragments of road traffic were based on the sounds from passenger cars and trucks recorded at distances of 12.5-60 m from a provincial road. The driving speed was equal to about 80 km/h. Each fragment consisted of partly overlapping passages of 10-12 different passenger cars and one truck, with a total duration of 45 s. The maximum A-weighted levels of the truck passbys were about 10 dB higher than those of the passenger car passbys (Versfeld and Vos, 1997, 2002).

The original sound recordings were further processed. To isolate the sound produced by a specific source from the background noise, the amplitude of the background noise was shaped over short time intervals of about 1 s just prior to the beginning (fade-in) and directly after the end (fade out) of the audible source-specific sound. All traffic sounds were subjected to this way of processing. I some recordings of the maglev train, highly prominent bird singing was removed by filtering as much as possible. The passage of the high-speed train recorded at a distance of 200 m contained non-specific low-frequency sounds. These sounds were removed with the help of a high-pass filter.

For each façade attenuation type, the level reduction was dependent on the frequency of the sound components. For the condition which simulated wide-open windows, an attenuation of 5 dB was assumed for frequencies between 12.5 and 1000 Hz. For higher frequencies the attenuation was 8 dB at most. With the windows closed, the façade attenuation increased from 12 dB for the 16-Hz and 31.5 Hz octave bands up to 35 dB for the 8-kHz octave band, and represented the average of noise attenuations that are frequently found for Dutch dwellings with the windows closed (Vos, 2001).

The sounds were reproduced in a relatively small listening room ($w \times 1 \times h = 3.5 \times 5.9 \times 3.3$ m). Specific resonance frequencies (such as those around 30 and 60 Hz) of the room, resulting in changes in the sound spectrum, as well as nonflat frequency characteristics of the audio equipment, were compensated as much as possible. Finally, for frequencies between 25 and 8000 Hz, a flat frequency characteristic was obtained within about 4 dB (standard deviation of the deviations in the various 1/3-octave bands equal to 2.6 dB).

Spectra of the sound fragments were determined with the help of a Larson-Davis spectrum analyzer (Model 3200) and a Bruel & Kjaer sound level meter (type 2236), with the microphone positioned at the ears of the subjects. The sound spectra are expressed as the linear sound exposure level in the various 1/3-octave bands. The reference sound pressure is always equal to 20 mPa. In the present article, spectra are shown in the condition which simulated wide-open windows only.

Figure 1 shows the linear sound exposure level in the various 1/3-octave bands for a few passages of the maglev train. For each driving speed only the spectrum in the condition with the highest outdoor ASEL (and smallest recording distance) is shown. For the lower ASELs (greater recording distances) the relative differences among the spectra were small. Figure 1a shows a characteristic spectral peak around 315 Hz for the driving speed of 100 km/h. For a speed of 200 km/h (Fig. 1b), such a peak is found around 630 Hz. The spectral peak around 315 Hz for the driving speed of 100 km/h and that around 630 Hz for the driving speed of 200 km/h result from the groove passage frequency of stator grooves spaced at 0.083 m (de Graaff et al., 2001). Due to aerodynamic noise at the speeds of 325 (Fig. 1c) and 400 km/h (Fig. 1d), the groove passage related frequency components do not longer determine the levels in the 1/3 oct. bands: Relevant spectral energy is found over a wide range between 100 and 2000 Hz.

Figure 2a shows two of the four sound spectra for the intercity trains. In addition to the smaller spectral peak around 31.5 and 63 Hz, a highly significant peak around 1600 Hz is obtained. Figure 2b shows three of the five spectra for the fragments with road-traffic sounds. Again, these sounds contain relatively much energy in a wide frequency range. A significant decrease in sound pressure level is found for frequencies higher than about 1600 Hz.

The sounds of the high-speed train passbys contained very much energy up to frequencies of about 3-4 kHz. For frequencies between 25 and about 160 Hz, large differences in sound level were obtained between the passby that was recorded at a distance of 50 m (ASELs of 85 and 90 dB) and the passby that was recorded at a distance of 200 m(ASELs of 75 and 80 dB). This difference must be the result of the high-pass filter that was used for 'improving' the quality of the passby sound recorded at the larger distance of 200 m. Apparently, the filtering had also affected the source-specific spectral content. Since the representativeness of the passby sounds presented at ASELs of 75 and 80 dB must be questioned, we decided to leave the annoyance ratings for the high-speed train passbys out of consideration.

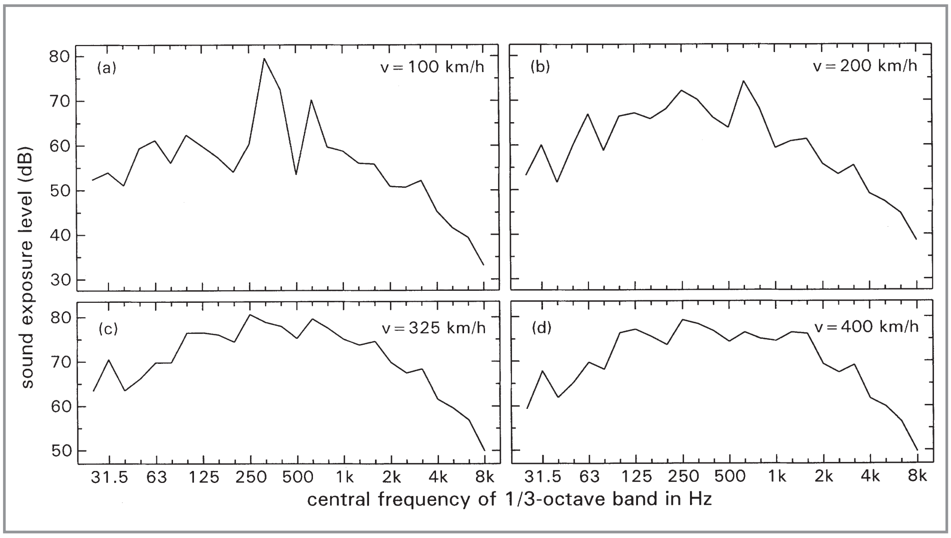

Figure 1. Spectra determined for four speeds of the maglev-train passbys, as determined at the ears of the subjects in the conditions which simulated open windows. For each driving speed, only the spectrum in the condition with the highest outdoor ASEL is given. During speed in km/h: a) 100, b) 200, c) 325, and d) 400.

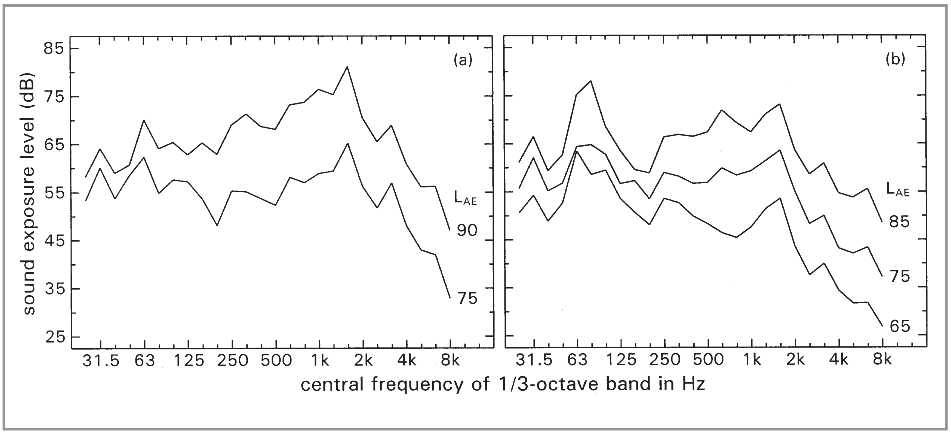

Figure 2. Spectra determined for sound fragments with a) Intercity trains and b) road traffic. The corresponding overall outdoor ASELs of the spectra are indicated.

In order to make the acoustic environment more realistic, a soft, spectrally shaped noise was continuously present throughout the experiment. In the condition which simulated open windows, the sound resembled traffic sounds as heard at a relatively great distance from a roadway. This background noise was presented at an A-weighted equivalent sound level of 35 dB, measured at the ears of the subjects. In the condition which simulated closed windows, it was felt that the background noise should resemble the sounds from the central heating system or the ventilation system. To achieve this, the background noise was further subjected to an overall reduction in sound level and an additional attenuation of the low-frequency components. In the listening room, this background noise was presented at an A-weighted equivalent sound level as low as 29 dB.

The spectra of the two background noise types are shown in Figure 3. The binaural hearing threshold of otologically selected young listeners is inserted in the figure to emphasize that in general, the sound components with frequencies lower than 63-100 Hz are no longer audible.

B. APPARATUS

The experiment was entirely computer controlled. The sounds were reproduced in the listening room by means of a loudspeaker (JBL-4425) hidden behind a curtain. The subjects were sitting behind a table furnished with a monitor and a keyboard. The distance between the listeners and the loudspeaker was about 3 m. For frequencies about 100 Hz, the reverberation time of the sound-insulated room was shorter than 0.5 s. hearing thresholds were determined with the hep of a Madson memory threshold audiometer (MTA 86) with the function switch in the auto-threshold mode with pulsating tones.

C. SUBJECTS

Twelve normally hearing subjects (six males and six females) between 23 and 34 years of age participated in the experiment. The mean age was equal to 27.2 years; the standard deviation equalled 4.1 years. Before the experimental sessions, the hearing thresholds of the subjects were determined between 250 and 8000 Hz for the left and right-hand ears separately.

Ten subjects had hearing levels ≤10 dB, and two subjects had hearing levels ≤15 dB in any part of the audiogram (best ears). The subjects were paid for their services.

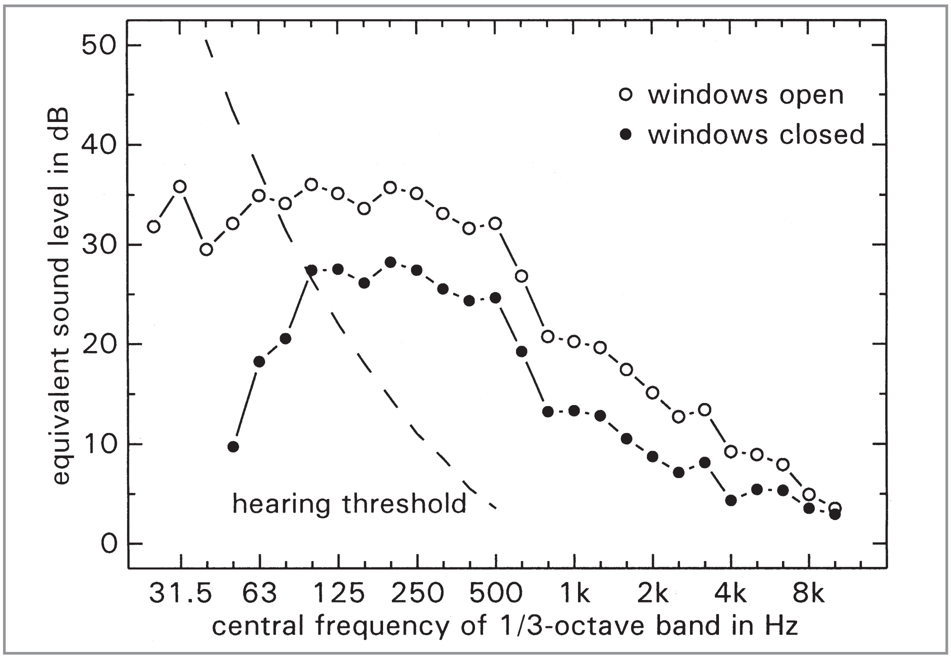

Figure 3. Linear weighted equivalent sound level in the various 1/3-octave bands of the background noise in two conditions, measured at the ears of the subjects. Inserted is the hearing threshold of young listeners.

D. PROCEDURE

After hearing levels had been determined, the subjects were seated in the listening room. The subjects were tested individually. The appropriate background noise (Fig. 3) was present from the beginning of the sessions. The subjects were told that they were exposed to conditions in which traffic sounds (cars and trains passing by) could be heard either for the entire time period of 45 s, or for a portion of this time period. The beginning and end of each 45 s condition was indicated on the monitor of their personal computer. After each condition the subjects responded to the question "How annoying would you find the sound in the preceding period if you were exposed to it at home on a regular basis?" They were instructed that while rating the sounds, they had to take into account everything that they heard in the 45 s time period. Moreover, they were encouraged to use the whole range of the rating scale with values from 0 ("not annoying at all") to 9 ("extremely annoying").

Six subjects started with the windows open condition, and the other six started with the windows closed conditions. Before these experimental blocks, the subjects received six representative sound fragments to familiarize them with the differences among the conditions. Both in the training blocks and in the experimental blocks, the presentation order of the sound fragments was randomized. To enhance the reliability of the results, each condition was presented twice for rating in separate blocks.

For annoyance scores greater than 4, both in the training block and in the second experimental block of each façade attenuation type, the subjects had to respond to five questions that informed about the causes of the expected annoyance. The preselected causes included were the perception of "loudness" and other specific sound characteristics such as "heavily pounding" or "banging", and "Squealing", "shrilly" or "squeaky". The other causes included were the feeling of "insecurity" or "unsafe" and the reaction of "startle". For each of these five questions, there were five response alternatives: quite correct, considerably correct, I don't know, not entirely correct, or not at all correct. In all conditions, the rating tasks were self-paced: the subjects were allowed to spend as much time for responding as they considered necessary.

3. RESULTS

As explained in Section 1, the annoyance is related to outdoor levels, and the results are presented for the two façade attenuation types separately. The responses of the subjects were considered reliable if the correlation coefficients, r, computed between the first and second ratings for each subject separately, were higher than 0.5. There was one subject who in the condition which simulated open windows did not fulfil this criterion. The data of the subject were replaced by those of a new subject with r-values that were considerably higher than the required criterion.

The actual r-values in the two façade conditions ranged between 0.54 and 0.88, with an overall mean value of 0.73 and a standard deviation of about 0.09. The reliability could therefore be considered to be very satisfactory. Moreover, analyses of variance performed on the annoyance ratings from various subsets of the data showed that the mean scores obtained in the first measurements were not significantly different from those obtained in the second measurements, and that in general, there were no significant interaction effects between replication and the stimulus variables.

A. ANNOYANCE IN THE WINDOWS-OPEN CONDITIONS

Figure 4a shows the annoyance scores, averaged across subjects and replications, as a function of outdoor ASEL for each sound source separately. The results from analyses of variance performed on subsets of the annoyance ratings showed that for all sound types, the annoyance significantly increased with ASEL, and that the annoyance ratings obtained for the intercity trains were significantly lower than those obtained for the maglev and road-traffic sounds.

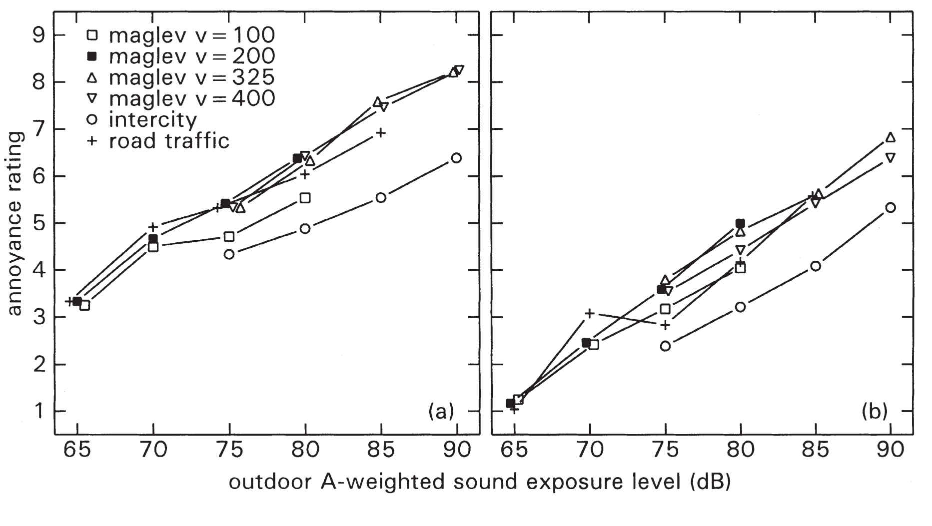

Figure 4. Mean indoor annoyance ratings for the various sound fragments, as a function of the outdoor ASELs. a) window open, b) window closed.

Taking for granted the small and hardly significant difference in annoyance between a) the sounds of the maglev train passing by at the speed of 100 km/h, and b) the sounds of the maglev train passing by at the speed of 200 km/h and the sounds of road traffic, three main conclusions may be drawn. At comparable ASELs 1) the annoyance was practically independent of the driving speed of the maglev train, 2) the annoyance caused by the maglev train was not different from the annoyance caused by road traffic, but 3) considerably higher than the annoyance caused by the intercity trains.

Figure 5a shows the three dose-response relations. The relations were obtained by linear fits of the 16 mean ratings for the maglev train (y = =9.47 + 0.198L_{AE}, r = 0.98), the five mean ratings for road traffic (y = -7.14 + 0.166L_{AE}, r = 0.98), and the four mean ratings for the intercity trains (y = -5.95 + 0.136L_{AE}, r = 0.995).

With road traffic as the reference, Figure 5a demonstrates that the bonus for the intercity trains varies from about 5 dB at LAE = 75 dB to abut 9 dB at LAE = 90 dB. The difference in annoyance between the two relevant train types can be quantified as well: The types are equally annoying if, dependent on sound level, the ASEL of the maglev-train passby-sound is 5-10 dB lower than that of the intercity-train passby-sound.

B. ANNOYANCE IN THE WINDOWS-CLOSED CONDITIONS

Figure 4b shows the annoyance scores, averaged across subjects and replications, for the conditions which simulated closed windows. The results from analyses of variance performed on subsets of the annoyance ratings again showed that for all sound types, the annoyance significantly increased with ASEL, and that the annoyance ratings obtained for the intercity trains were significantly lower than those obtained for the maglev and road-traffic sounds. The unexpectedly high annoyance caused by the road-traffic sounds at an ASEL of 70 dB is related to the casual presence of relatively much low-frequency energy in the truck passby sound.

Again, three main conclusions may be drawn. At comparable outdoor ASELs 1) the annoyance was practically independent of the driving speed of the maglev train, 2) the annoyance caused by the maglev train was not different from the annoyance caused by road traffic, but 3) considerably higher than the annoyance caused by the intercity trains.

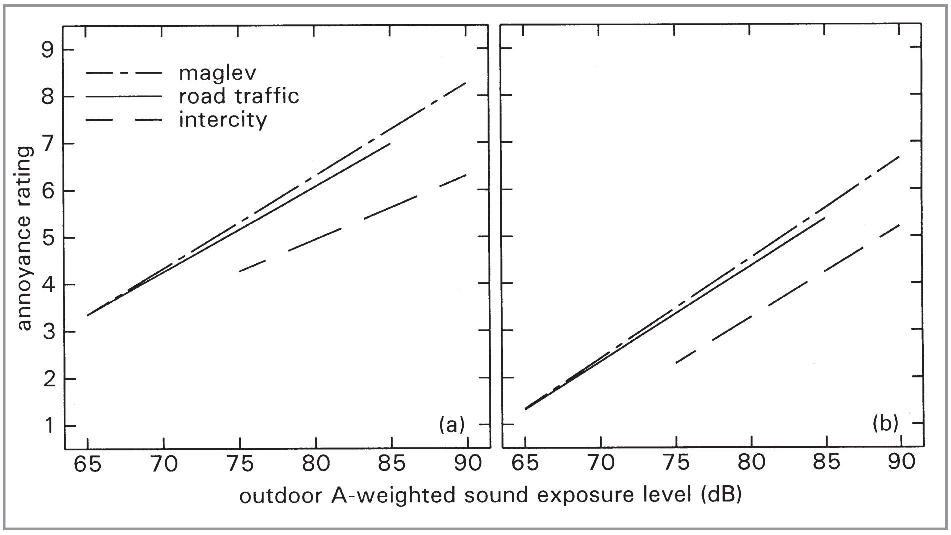

Figure 5. Dose-response relations for maglev train, road traffic and intercity train, a) windows open, b) windows closed.

Figure 5b shows the three dose-response relations. The relations were obtained by liner fits of the 16 mean ratings for the maglev train (y = -12.5 + $0.213L_{AE}$, r = 0.99), the five mean ratings for road traffic (y = - 11.9 + $0.203L_{AE}$, r = 0.96), and the four mean ratings for the intercity trains (y = - 12.3 + $0.194L_{AE}$, r = 0.995).

With road traffic as the reference, Figure 5b demonstrates that the bonus for the intercity trains is equal to about 5 dB. In contrast with the results obtained in the conditions which simulated open windows, this bonus is independent of sound level. The difference in annoyance between the two relevant train types can be quantified as well: The types are equally annoying if the ASEL of the maglev-train passby sound is 6 dB lower than that of the intercity train passby sound.

C. CAUSES OF THE EXPECTED ANNOYANCE

As indicated in Sec. 2 D, the subjects had also been asked about the causes of their expected annoyance. Recall that the five questions were asked only 1) in the blocks in which the sound fragments were rated for the second time, and 2) if the annoyance score was greater than 4. Collecting information about causes of the annoyance in conditions in which the subjects only expected to be a little or moderately annoyed, was considered to be irrelevant.

Overall loudness

For all sound types loudness was selected as a cause of the annoyance. This was most prominent[2] for the sound fragments presented at the higher sound levels (outdoor L_{AE} ≥75 dB) in the conditions which simulated open windows. In the conditions which simulated closed windows, a majority of the subjects had selected this cause only for the sound fragments that had been presented at, say, outdoor L_{AE} ≥ 85 dB.

Specific sound characteristics

The shrilly sound character of a few passages of the maglev train as a cause of the annoyance was chosen in the conditions which simulated open windows. In the windows-closed conditions, the shrillness of the sound was no longer an important cause of the annoyance, which can be understood from the effective façade attenuation of the pertinent high-frequency components.

Feeling of insecurity

In the conditions which simulated open windows, the majority of the subjects (with n >6) selected insecurity or unsafety as one of the causes of the maglev train (outdoor L_{AE} ≥ 85 dB) passing by at velocities of 325 and 400 km/h. For the same sounds in the conditions which simulated closed windows, the relevance of the feeling of insecurity was much lower.

Startle

Independent of the façade attenuation type, the startle reaction to the sound as a cause of the annoyance was frequently mentioned in the conditions in which the ASEL of the sound of the maglev train passing by at a velocity of 325 or 400 km/h, was 85 or 90 dB.

4. DISCUSSION

A. RAILWAY BONUS

Both in the windows-open and in the windows-closed conditions, the annoyance caused by the intercity trains was considerably lower than that caused by road traffic, provided that the ASELs were the same. Averaged across the two façade attenuation types, the bonus for

[2] for example, restricting ourselves to those conditions in which more than six of the twelve subjects had answered the questions, loudness had been indicated as one of the causes of the annoyance in 80-100% of the cases.

the intercity trains was equal to about 6 dB. Support for a railway bonus has been found in field surveys conducted more than 20 year ago (e.g., see Heimerl and Holzmann, 1979); Schumer-Kohrs et al., 1981; Knall and Schumer, 1983; Fields and Walker, 1982). From the dose-response relationships for road-traffic and railway sounds obtained in a recent meta-analysis (Miedema and Oudshoorn, 2001), it can be revealed that for A-weighted day-night levels between 50 and 70 dB, the railway bonus varies between 5 and 8 dB.

Figure 6 shows the railway bonus as a function of the day-night level of railway sounds for three different annoyance measures given in Miedema and Oudshoorn (2001). The lower curve in Fig. 6 was derived from the relationships with the community response expressed as the percentage of respondents who were at least a little annoyed (LA). The two higher curves in Fig. 6 were derived from the relations with the response expressed as the percentages of respondents who were at least moderately (MA) or at least highly annoyed (HA). It can be concluded that the railway bonus is only slightly affected by the day-night level and the annoyance measure, and that 6 dB is the typical value.

As a result, the bonus for the intercity trains obtained in the present experiment corresponds well with the mean bonus found in field surveys for residential areas with moderate to high exposure levels. It should be emphasized that in contrast with the preliminary loudness data reported in Fastl and Gottschling (1996) and in Gottschling and Fastl (1997), the results of the present experiment do not support application of such a bonus to the maglev-train sounds.

The satisfying correspondence between the railway bonuses obtained in our experiment and in various field surveys, supports the validity of the present laboratory study. One might argue that the 6-dB bonus is merely the result of specific features of the experimental method or the sound fragments. One such feature might be the stimulus duration, affecting ASEL of the two sources in a different way. However, it is unlikely that a change in stimulus duration would affect the size of the bonus, as can be understood from the following argument.

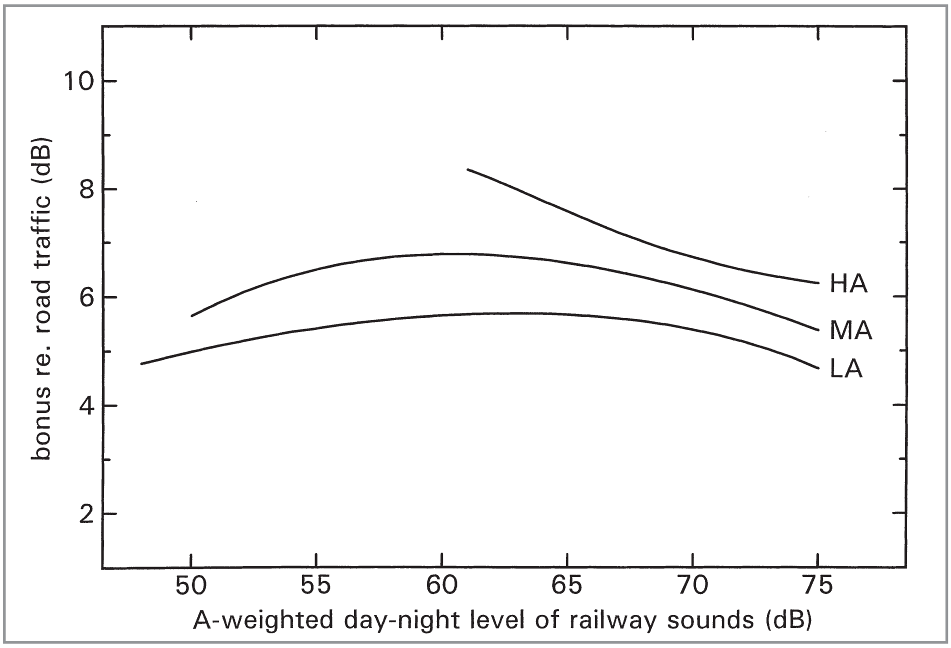

Figure 6. Railway bonus derived from dose-response relationships reported in Miedema and Oudshoorn (2001), as a function of the day-night level of railway sounds, for three different annoyance measures.

For the same density of the road-traffic sounds, a doubling of the stimulus duration results in a 3-dB increase in ASEL. With still one passage of the intercity train, a doubling of the total stimulus duration (i.e. the relevant rating period) has no effect on its ASEL. Relative to the condition with the shorter duration, the annoyance caused by the road-traffic sounds with the longer stimulus duration may be expected to remain the same. The annoyance caused by the railway sound, however, is expected to decrease as a result of the favourably judged large increase of the time period without noise (Vos, 1992a, 1992b; Vos & Geurtsen, 1992, 1995). If this decrease in annoyance is equal to the change in annoyance produced by a 3-dB shift in the sound exposure level of the intercity train, there will be no change in the previous railway bonus at all.

Again for the same density of the road-traffic sounds, halving of the stimulus duration (from 45 s to 22.5 s) results in a 3-dB decr4ease in ASEL. With still a single passage of the intercity train, halving of the total stimulus duration has no effect on its ASEL. Relative to the condition with the longer duration, the annoyance caused by the road-traffic sounds may be expected to remain the same. The annoyance caused by the railway sound, however, is expected to increase as a result of the lack of the favourably rated quiet period. Once more, if this increase in annoyance is equal to the change in annoyance that results from a 3-dB increase in the sound exposure level of the intercity train, the railway bonus in this hypothetical stimulus configuration will be equal to the bonus obtained in the present experiment.

B. ISSUES FOR FUTURE RESEARCH

In the previous section it was shown that there is sufficient support for a bonus for the more conventional railway sounds. Although at present there is little direct evidence of the reasons for this railway bonus (e.g., see Fields and Walker, 1982), the more plausible explanations may have to do with the relatively long quiet periods between passbys and with attitudinal variables such as "fear" and "importance" (Fields, 1993; Miedema and Vos, 1999). Both a low fear level associated with railways (trains don't fall out of the sky or run into people's houses) and a strong belief that the railways are economically or otherwise important for the local area or some broader community, might reduce the annoyance.

In the present laboratory study, the annoyance caused by the maglev-train sounds was higher than the annoyance caused by the sounds from the intercity trains. It might be hypothesized that this effect is at least in part due to the fact that our listeners were not familiar[3] with the maglev train. With the passage of time, residents could potentially develop positive attitudes toward maglev trains, resulting in a decrease of the difference in annoyance between the two train types.

For example, information about various measures of precaution might reduce fear and, subsequently, noise annoyance. For exploring the contribution of the non-acoustic factors

[3] Our subjects were told that they were exposed to sounds of passing cars and trains. Although they were not explicitly asked to identify the source of the maglev-train sounds, there is no reason to believe that they would not have been able to assign the maglev-train sounds to the category of "railway-like" sounds. In spite of the fact that, just as our participants, none of the subjects in the studies reported by Fastl and Gottschling (1996) and by Gottschling and Fastl (1997) had heard the maglev-train sounds before, all of them had identified the sounds as "train noise". Identifying the maglev-train sounds as "train noise" however, does not mean that our subjects were familiar with these sounds to the same degree as they are with the more conventional intercity trains.

described above, the present experiment should be enlarged, amongst other thins by providing information about the various sound sources and by accompanying the sounds with realistic images of the passing vehicles and trains.

5. CONCLUSIONS

At equal outdoor A-weighted sound exposure levels, (1) the annoyance was virtually independent of the speed of the maglev-train passages, (2) the annoyance caused by the maglev-train passby sounds was hardly different from the annoyance caused by the road-traffic sounds, and (3) the annoyance caused by the intercity train passages was considerably lower than that caused by the maglev-train and road-traffic sounds. These results (4) held true both for open and for closed windows.

Moreover, it was concluded that (5) the sounds might be expected to be equally annoying if the outdoor sound levels of the maglev-train passbys are at least 5 dB lower than those of the intercity train passbys, and (6) in addition to perceived loudness, startle reactions and feelings of insecurity might play a role in the annoyance caused by the sounds of the maglev train.

ACKNOWLEDGMENTS

This research was financed by Project Group Zuyderzeeline (Ministry of Transport, Public Works and Water Management, and Ministry of Housing, Spatial Planning, and the Environment), The Netherlands. This article is an abridged version of "Annoyance caused by the sounds of a magnetic levitation train," published in the Journal of the Acoustical Society of America Vol.115 (4), 1597-1608, April 2004.

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NEW YORK LEADS THE WAY

There is a new noise law on the books in New York City since noise complaints make up the most number of calls to the city's 311 hotline. Last year the hotline received more than 335,000 noise complaints. Mayor Michael Bloomberg, said the new noise code updates previous laws that were more than 30 years old. When the regulations become effective in 2007, nightclubs and bars will have to keep their noise level (outside the premises) down to 42 dB from 45 dB - every NYPD patrol car will be equipped to with a sound meter to measure noise levels. Ice Cream vans may only play their tunes while on the move, dog owners, whose pets bark for more than 10 minutes during the day and 5 minutes at night, will be fined, no construction work between 6pm and 7am, mobile phone owners who use their device during a public performance - a film, or a play - will be fined $50.

BINGO GRANNIES ROW

Bingo players could be the latest victims of the licensing laws fiasco as families living near a bingo hall oppose plans for longer opening hours because they fear of rowdy behaviour could be a problem. People living near the Mecca Bingo Hall, on Aylsham Road in Norwich have complained about “unruly” and “bad” behaviour from players as they leave the club an accused them of being “abusive” to residents. They are also charged with beeping their car horns in celebration as they leave after a night of bingo.

CHICHESTER PUBS

Cathedral and community lined up to oppose new longer opening hours proposed for two Chichester city centre pubs - and won a partial victory. District councillors decided to pare back new hours proposed for the White Horse, in South Street, and the Park Tavern, in Priory Road, after the first of a series of hearings. Conditions aimed at limiting noise were also imposed, but in both cases the pubs will still be open longer than they are now. The decisions come amid fears about the prospect of increased city centre disorder, vandalism, petty crime and binge drinking, in the wake of the government’s controversial licensing reforms.

OKINAWA & U.S. MARINES

As the P3C patrol aircraft from Kadena Air Base roared over the Ueojana community centre in Ginowan, Japan, a noise level recorder on the roof hit 96 decibels. The plane was flying so low, people on the ground could read the numbers on its fuselage. This city has come to symbolise Okinawa Prefecture’s heavy burden in hosting U.S. military facilities in Japan. But for many people in areas near the airstrip of the U.S marine Corps Air Station Futenma, he burden has become unbearable, now that aircraft from other bases returning from missions in Iraq use Futenma for military exercises. Elderly people can’t sleep, frightened children plug their ears - and residents are fed up. “How long do we have to put up with this abuse?” Ryoichi Tsuhako, 62, head of the Ueojana residents’ association, asked. Tokyo and Washington agreed on a plan in October to relocate functions from the Futenma air station to a spot in the Henoko district of Nago in the prefecture. No date for the move has been set. But Tsuhako says the relocation, whenever it happens, is simply shifting the problem to other residents in the prefecture. “Some people expect the relocated airstrip will help revive their local economy,” he said. “Bt they have no idea how terrible the noise pollution is, even though they live in the same prefecture.” For 27 days in November, noise levels at the Ueojana centre, about 400 meters from the Futenma airstrip, varied from 90 decibels to 100 decibels, the level of noise heard below an overpass when a train passes overhead. The highest level was 106 decibel. The flight schedule had been reduced after a helicopter from the Futenma station crashed at the nearby campus of a university, injuring three crew membes but no civilians, in August 2004. In April 2005, however, troops from Iraq returned to Futenma and resumed their flight drills. From late October, aircraft usually based elsewhere began drilling in the Futenma air space. Ginowan’s Nodake district is a crowded residential area that houses city government offices. It is only a kilometre from the air station runway. Some senior citizens complain of a lack of sleep and have obtained prescriptions for sleeping pills, Taba added. The city operates a hot line for citizens. It receives complaints daily from people frightened by the aircraft swooping so low that the pilot’s faces are visible, or about children unable to sleep. The city sent more than 10 faxes of protest t the officials of the U.S. military base from October t December. But there has been no response, city officials said.

BULGARIAN REGULATION

Offences related to excess noise level limits will result in BGN 500-1,000 fines for individuals and penalty payments of BGN 1,000-3,000 for businesses. This is provided in the Protection against Environmental Noise Law passed by Parliament at second reading recently. The law will come into force at the beginning of 2006. The law covers all kinds of noise sources, including disco clubs, bars, automobiles, planes, etc. Authorities have a window of two years to supply the necessary equipment for noise observation and measurement, the law envisions.

BARRIERS FOR INTERSTATE 5

Public meetings have been held in the town of Everett, to consider sound barriers on Interstate 5 as it runs by the town. It is state Department of Transportation officials who seem keen on barriers, the public not particularly enthused. The noise barriers will be built in areas where noise is above 67 decibels. The intention will be to reduce noise by 5 decibels. As well as reducing noise, the walls are expected to have a psychological effect on people's perception of noise: those who can see a freeway generally think noise is louder than it actually is; conversely, if a wall blocks the view, people think there is less noise than there actually is.

HORNS IN KACHMIR

#A lawyer has filed a Public Interest Litigation (PIL) in the High Court in Kashmir demanding a ban on pressure horns. The division bench of the High Court has issued notices on the PIL to Road Transport Officer, Chairman Pollution control Board (PCB) and Inspector General of Police (Traffic). The PIL filed by Advocate G. M. Wani, has presented a detailed picture of the traffic scenario in the state, terming it bleak. "Thanks to the gross negligence of the traffic department, the vehicular traffic in the capital city has turned into a major source of public nuisance," the PIL said. "The shrill sound has disturbed peace and tranquillity of people and has become cause of various ailments," it said, asking the Court to prohibit the blowing of horns on public places.

LOW FREQUENCY PECULARITIES

Residents fed up with the "thump thump, thump" they say keeps them awake at night want stiffer penalties for a Springdale (Arkansas) club owner who has been cited 60 times for noise complaints. The Springdale Civic Centre at presents something of a mystery. The building has soundproofed walls, and music can't be heard in the parking lot, police and city officials said. But residents living up to a mile west say the thumping bass disturbs them almost every weekend. The Civic Centre, has been cited 60 times for noise violations since early 2003. Owner Edward J Vega paid $5,000 to settle 45 citations in 2004, and a trial date is set in Springdale District Court for 15 more violations. Vega, said that many of the complaints have no merit. "How can you have only two or three people hearing the noise inside an area with more than 500 residents? On many occasions they have showed up when we don't have an event going and no music is playing at all." Truly peculiar.