Establishing the Asian Socio-Acoustic Survey Data Archive

H.Q. Nguyen[1], M. Takata[1], T.L. Nguyen[1], T. Yano[1], K. Masden[2], S. Yokoshima[3], M. Morinaga[4] and I. Yamada[5]

[1] Graduate School of Science and Technology, Kumamoto University, Kurokami 2-39-1, Chuo-ku, Kumamoto 860-8555, JAPAN, nhuyquang@yahoo.com, linh2lan@gmail.com, takata.m@arch.kumamoto-u.ac.jp, yano@gpo.kumamoto-u.ac.jp

[2] Faculty of Economics, Kumamoto Gakuen University, masden@kumagaku.ac.jp

[3] Kanagawa Environmental Research Center, yokoshima@k-erc.pref.kanagawa.jp

[4] Defense facilities Environment Improvement Association, morinaga@dfeia.or.jp

[5] Aviation Environment Research Center, i-yamada@center.aeif.or.jp

ABSTRACT

A number of socio-acoustic survey data sets should be accumulated in each country for the effective formulation of noise policy, because community response to noise varies among different cultures. While noise policies have progressed based on the findings obtained through reanalysis of datasets accumulated in the TNO data archive, there is a lack of socio-acoustic surveys for noise policies in Asia. In 2011 the Japanese Socio-Acoustic Survey Data Archive (J-SASDA) was established in the Institute of Noise Control Engineering/Japan. The secondary analysis has just started. The outcomes were reported at international congresses and have been used for discussion at the ISO meeting in December 2012 and in the formulation of noise policies in Japan. In this paper the authors emphasize the importance of establishing the Asian Socio-Acoustic Data Archive (A-SASDA) and encourage Asian researchers to join the network to establish the archive for the future global noise policies.

1. INTRODUCTION

A number of socio-acoustic survey data sets should be accumulated in each country for the formulation of effective noise policy, because community response to noise varies among different cultures. For example, railway bonus is frequently found in European countries but rarely in Japan. In the 1990s the TNO (Netherlands Organization for Scientific Research) established a data archive by collecting socio-acoustic survey data sets mainly from European and American countries (Fields 1997). Miedema et al. published papers on exposure-response relationships for transportation noises, effects of non-acoustic factors on annoyance, validity of night time penalty, seasonal and climatic effects, and so on (Miedema et al. 1998; 1999; 2000; 2003; 2004; 2005). Parts of the findings were reflected in EU position papers and EU noise policies (European Commission 2002; 2004).

On the other hand there is a lack of socio-acoustic surveys for noise policies in Asia (Bassarab et al. 2009). In 2011 the Japanese Socio-Acoustic Survey Data Archive (J-SASDA) was established in the Institute of Noise Control Engineering/Japan (Yokoshima et al. 2011). The secondary analysis has just started (Yokoshima et al. 2012). The outcomes were reported at international congresses and have been used for discussion on the railway bonus at the ISO meeting in December 2012. It was accepted at the meeting that railway bonus is not applicable at least in Japan. Wind

turbine noise has emerged as a serious social problem among people living in areas close to wind turbines in Japan since the 2000s. A systematic research project was performed throughout Japan from Hokkaido, a colder area of Japan through Okinawa, a warmer area from 2010 to 2012 (Tachibana et al. 2013; Kuwano et al. 2013; Yano et al 2013). The results are compared with the other noise sources for wind turbine noise policies.

In the 21st century, noise problems are likely to be serious in Asian countries because of rapid economic growth and traffic network development. In this paper the authors emphasize the importance of establishing the Asian Socio-Acoustic Survey Data Archive (A-SASDA) and encourage Asian researchers to join the network to establish the archive for the future global noise policies.

2. STANDARDIZED NOISE ANNOYANCE SCALES AND GUIDELINE FOR REPORTING CORE INFORMATION FROM SOCIO-ACOUSTIC SURVEYS

Team 6 (Community Response to Noise) of the International Commission on Biological Effects of Noise (ICBEN) developed the verbal and numeric standardized noise annoyance scales (Fields et al. 2001) and the guidelines for reporting core information from community noise reaction surveys (Fields et al. 1997). These are quoted in ISO Technical Specification 15666 (2003) and are very useful in comparing community response to noise among surveys locally and globally. The question with a verbal standardized annoyance scale is phrased as follows: “Thinking about the last (12 months or so), when you are here at home, how much does noise from (noise source) bother, disturb or annoy you: not at all, slightly, moderately, very or extremely?” The question with a numeric scale is as follows: “Thinking about the last (12 months or so), when you are here at home, what number from 0 to 10 best shows how much you are bothered, disturbed or annoyed by (source) noise? If you are not at all annoyed choose 0; if you are extremely annoyed choose 10; if you are somewhere in between, choose a number between 0 and 10.” The core information is overall survey design, social survey sample, social survey data collection, acoustical conditions and basic dose-response analysis. The summary can be downloaded at the following URL: http://www.icben.org/Team6.html.

3. ESTABLISHMENT OF SOCIO-ACOUSTIC SURVEY DATA ARCHIVE IN JAPAN

Miedema et al. established a socio-acoustic survey data archive in TNO and published papers on the effects of environmental noises on people (Fields 1997; Miedema et al. 1998; 1999; 2000; 2003; 2004; 2005). The outcomes from their studies are reflected in EU position papers and noise policies (European Commission 2002; 2004). On the other hand we encountered difficulties in setting and revising environmental standards for noise in Japan because we had not systematically accumulated socio-acoustic survey data sets. Therefore the Socio-Acoustic Survey Data Archive in Japan (J-SASDA) was established in the Institute of Noise Control Engineering, Japan (http://www.ince-j.or.jp/04/04_page/04_3.html)*[1]. Twenty three data sets have so far been accumulated in the archive. Table 1 compares the approximate sample sizes available in the TNO archive and J-SASDA.

Figure 1 compares exposure-response curves for transportation noises in an EU position paper (European Commission 2002). This shows that aircraft noise is more annoying than road traffic noise (aircraft penalty) and that railway noise is less annoying than road traffic (railway bonus). However, in Figure 2 Yokoshima et al. compare exposure-response curves by using Japanese data sets of J-SASDA in which annoyance was evaluated with the ICBEN 5-point verbal scale. Here, unlike

the EU curves, railway noise is more annoying than road traffic noise. This strongly suggests that the railway bonus is not applicable at least in Japan. Such a difference between the EU and Japan brought a hot discussion at the ISO meeting in 2012. In ISO 1996-1 CD1, the typical level adjustment for railroad with reference to road traffic is -3 to -6 dB considering the trend in Figure 1. The level adjustment is now being reviewed among the members

*1: This is the Japanese version. The English version is under construction.

Table 1 Sample sizes of data sets in TNO Data Archive and J-SASDA

	Aircraft	Road traffic	Railway
TNO (2011)	62,000	32,500	13,500
SASDA (2013)	1,800 Commercial: 900 Military: 900	6,700	12,700 Conventional: 8,700 Shinkansen: 4,000

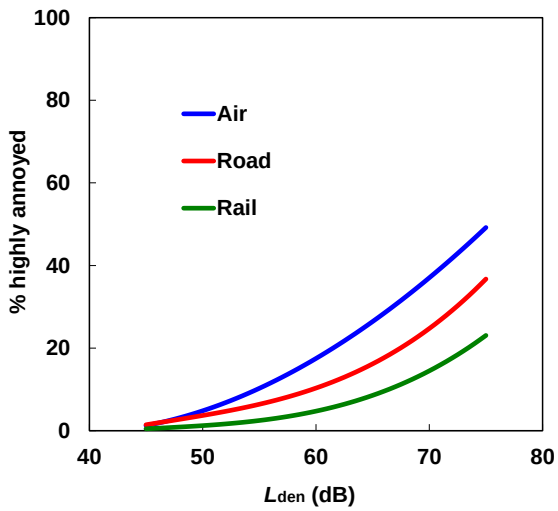

Figure 1 Exposure-response curves for transportation noises in EU position paper

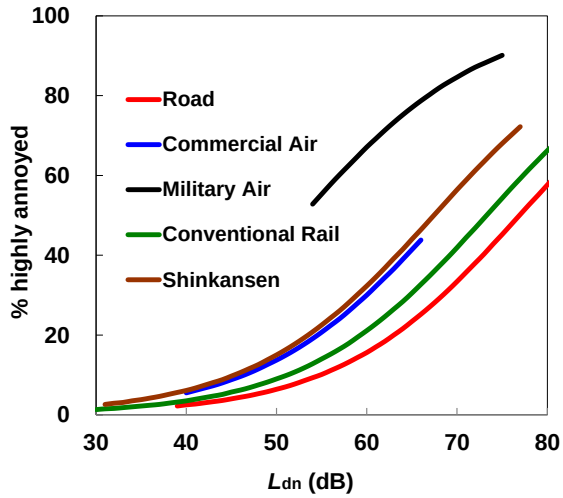

Figure 2 Exposure-response curves for transportation noises obtained from data sets of J-SASDA

4. COMPARISON OF EXPOSUE-RESPONSE RELATIONSHIPS BETWEEN ROAD TRAFFIC AND WIND TURBINE NOISES

Wind turbines have been highlighted as an important renewable energy source. As is widely recognized across the world, wind turbine noise has emerged as a serious social problem among people living in areas close to wind turbines. While wind turbine generators have frequently been constructed since the 2000s in Japan, noise problems have occurred around them. Thus a nationwide research project on the effects of wind turbine noise on people was carried out from Hokkaido, a colder area, to Okinawa, a warmer area of Japan under the auspice of Ministry of the Environment, Japan from 2010 to 2012. In a total of 747 responses obtained in which 651 noise exposures were identified. Since wind turbine noise level is generally very low and serious during nighttime, $L_{\mathrm{Aeq,\ night}}$ was measured when wind turbine generators operated at the rated powers. Assuming that wind turbines operated at the rated powers all day long, the L_{dn} values were calculated.

The L_{dn}-response relationship was compared with that of road traffic noise which was drawn based on the data from J-SASDA (n=3834) as shown in Fig.3. These curves were precisely compared since annoyances caused by both noises were evaluated with the ICBEN 5-point verbal scale. There is around 10 dB difference between wind turbine and road traffic noises at 10 to 20% extremely annoyed. This is consistent with the findings obtained from Swedish and Dutch surveys (Janssen et al. 2011). This strongly suggests that wind turbine noise was at least 10 dB more annoying than road traffic noise and thus this finding should be considered for the wind turbine noise policies in Japan.

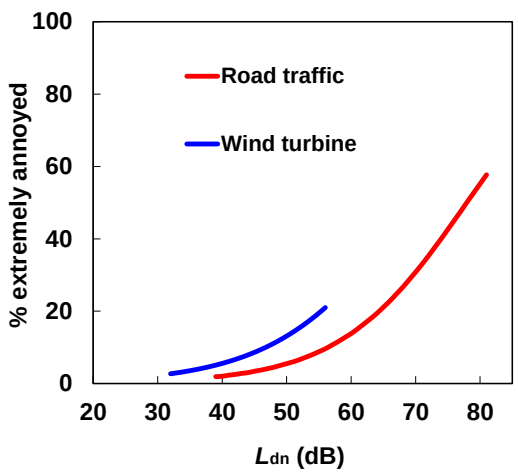

Figure 3 Comparison of exposure-response curves for wind turbine and road traffic noises in Japan

5. TOWARDS THE ESTABLISHMENT OF SOCIO-ACOUSTIC SURVEY DATA ARCHIVE IN ASIA

The authors have conducted social surveys on community response to transportation noises in Vietnam in order to contribute to Vietnamese and global noise policies. First a road traffic noise survey was carried out in Hanoi in 2005, followed by a road traffic noise survey in Ho Chi Minh City in 2007, an aircraft noise survey in Ho Chi Minh City in 2008, an aircraft noise survey in Hanoi in 2009, a railway noise survey in Hanoi in 2010, road traffic and aircraft noise surveys in Da Nang in 2011, road traffic and

railway noise surveys in Hue 2012 and a road traffic noise survey in Thai Nguyen in 2013 (Phan 2010; Nguyen 2011). At the present time approximately 10,000 responses have been collected in Vietnam. We are also planning social surveys on community response to a step change in aircraft noise exposure due to the construction of a new air terminal of Noi Bai Airport in Hanoi in 2014.

Figure 4 compares exposure-response curves for transportation noises among EU, Japan and Vietnam. Though both 5-point verbal and 11-point numeric scales were used in the Vietnamese surveys, the top three categories from the 11-point numeric scale were taken as high annoyance for the Vietnamese curves. The Japanese and EU curves were quoted from Figures 1 and 2. Since the sample sizes of aircraft noise surveys in Japan and railway noise surveys in Vietnam are much smaller than EU's, the curves cannot be compared with each other. Also the number of trains per day was substantially lower in Vietnam. Though the Japanese people were slightly more annoyed by road traffic noise than in the EU, the Japanese people were much more annoyed by railway noise. On the other hand, though the Vietnamese curve for aircraft noise is comparable with the EU's, the Vietnamese people were less annoyed by road traffic noise than the people of EU and Japan. This means that community response to noise varies depending on the cultural background and that the data should be accumulated in individual countries. In order to formulate appropriate noise policies and countermeasures, it is very useful to compare directly the community response among countries. The Vietnamese data sets will be deposited to SASDA to establish the Asian Socio-Acoustic Survey Data Archive (A-SASDA) in a few years.

Hong and Lim have actively carried out social surveys on community response to transportation noises in Korea (Hong 2010; Lim 2008; 2007; 2006). We have just started to discuss how to incorporate Korean data sets into A-SASDA.

Asian researchers who have engaged in noise research are strongly encouraged to conduct social surveys in their countries and to deposit their data sets to A-SASDA after their primary analyses. After the deposit qualified people can reanalyze any data sets only for academic purposes with a simple procedure.

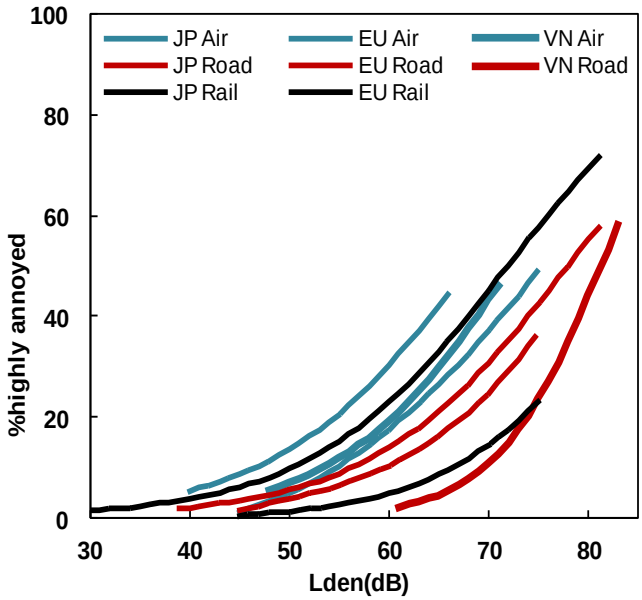

Figure 4 Comparison of exposure-response curves for transportation noises among EU, Japan and Vietnam

6. CONCLUSIONS

The authors established the Japanese Socio-Acoustic Survey Data Archive in the Institute of Noise Control Engineering/Japan. By reanalyzing the data from the archive exposure-response curves were compared among transportation noises and between wind turbine and road traffic noises. The exposure-response curves for transportation noises were also compared among EU, Japan and Vietnam. These comparisons are very useful for future national and global noise policies. Finally we emphasized the importance of establishing the Asian Socio-Acoustic Data Archive.

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