



INFORMATION BULLETIN

EPA NOISE SURVEYS 2007

Publication 1169 October 2007

EPA Victoria has recently undertaken studies to better understand the significance and effects of environmental noise across Victoria.

A community response to environmental noise study (Social Survey) was conducted in late 2006 to better understand the impact of noise on the community and assist with future noise management programs.

An environmental noise measurement survey (Measurement Survey) was also completed in early 2007, measuring noise levels at 50 sites across the inner, middle and outer suburbs of Melbourne.

Environmental noise impacts on peoples' lives through annoyance, sleep disturbance, reduced work or school performance, stress and anxiety, reduced enjoyment of home life and other physical health effects.

Noise levels measured across Melbourne are similar to those measured in the past, despite growth in traffic volumes and increased urbanisation. However, more people are affected by noise than 20 years ago.

Noise from traffic and neighbours are the most common sources affecting people in Victoria. Seventy per cent of people hear traffic noise in their homes and over one million Victorians are annoyed by it. Traffic noise is also the loudest noise source. Neighbour noise annoys about 900,000 Victorians. Televisions and music are the most common issues. Noise from construction at residential and other premises is also significant.

KEY FINDINGS – SOCIAL AND MEASUREMENT SURVEYS

Annoyance

One way of measuring how noise impacts on the community is to look at how many people are annoyed. The Social Survey found that almost half of Victorians (49 per cent) were disturbed or annoyed by environmental noise at some stage in the past 12 months.

Sleep disturbance

Sleep disturbance from noise can have negative effects on physical and mental wellbeing, including increased blood pressure and heart rate, reduced concentration, fatigue and depressed mood.

Noise is defined as unwanted or undesirable sound. Environmental noise includes noise emitted from many sources in the community.

One-quarter (24 per cent) of respondents to the Social Survey reported sleep disturbance from environmental noise at some stage in the last 12 months.

Day and night

Noise levels increase with human activity, urbanisation and industrialisation, generally following the pattern of motor vehicle use throughout the day and week. For example, the quietest period of the day is in the early hours of the morning from 2 am to 4 am. Noise levels increase during the morning and afternoon peak hours and gradually reduce through the evening and into the night.

Weekend mornings (6 am to 12 midday) are significantly quieter than weekday mornings. However, the few hours after midnight on weekends are louder than during the week (Figure 1).

Overall, nights, weekday early mornings and weekend mornings are the quietest times measured, reflecting less traffic. The Social Survey found that many noise sources cause greatest impact during these times, when the general ambient noise levels are lower.

The survey findings indicate that sleeping, resting and relaxing are important for the Victorian community, and that people are particularly concerned when noise disturbs these aspects of home life.

Road traffic noise

Road traffic noise is the main noise source affecting the Victorian community. This is due to its prevalence and high noise levels. It annoys, disturbs sleep and interrupts reading, relaxing and quiet activities.

Residential noise

Residential areas far from industry and transport noise are the quietest. However, the social survey found that neighbour noise is second only to road traffic noise in the level of annoyance across Victoria. If construction noise coming from homes is also considered, the level of disturbance from residential activities is comparable to that from traffic.

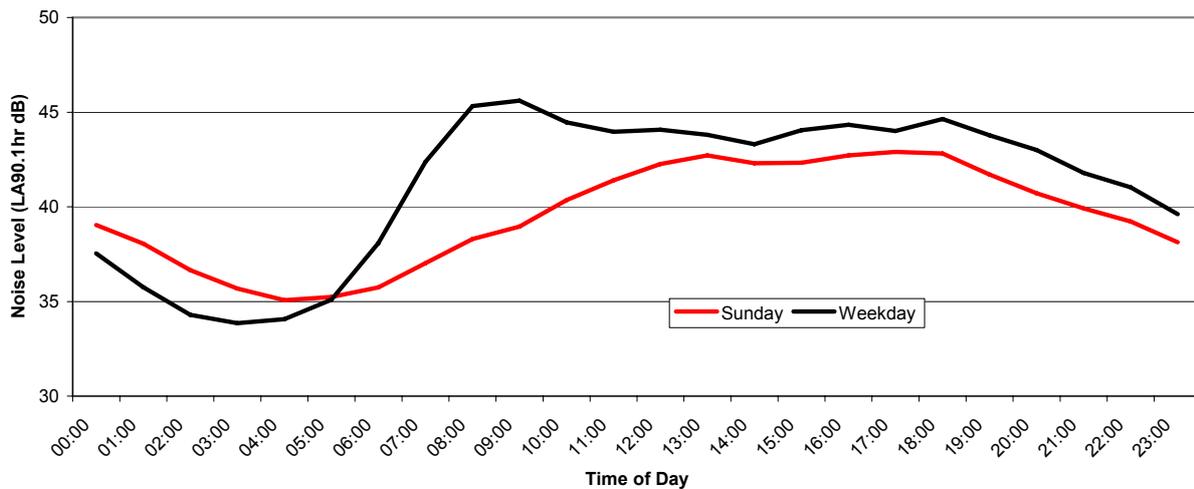


Figure 1: Average noise level for each hour of the day

Annoyance from neighbour noise comes from more than just the noise itself (its volume, pitch or duration). For those annoyed, a main factor is lack of consideration shown by the noisemaker. Neighbour noise is seen as showing a lack of respect for others and as largely preventable through a neighbour's actions.

Neighbour noise also tends to be irregular or unpredictable. This means it is less likely to become part of the background noise, which after a while many people become accustomed to and not notice. Also, people are more likely to adapt to noise that has a purpose or function. For example, people generally appear to be less annoyed by a regular and functional noise source such as passenger trains compared to a neighbour's television, music or parties.

Other main noise sources

Alarms and construction noise also annoy and disturb a substantial proportion of Victorian residents, with residential building/renovations and burglar alarms being the most prevalent.

Industrial noise was found to be quieter overall than road traffic noise and impacts upon far fewer people, with 10 per cent of Victorian residents hearing industrial noise at their homes. However, industries located near dwellings can dominate the noise experienced, particularly at night and can impact significantly on those local residents.

Changes over time

Both the 2006 Social Survey and a similar survey in 1986 found that traffic and residential noise affect the greatest proportion of the community.

While the amount of traffic has increased in Melbourne, urban noise levels are generally similar to the 1970s. Newer vehicles being quieter may explain this. However, the social survey found that the percentage of people exposed to and annoyed by traffic noise has increased since 1986. This would indicate that, although the measured roads have similar noise levels, there are now more 'busy' roads across Victoria, with more people living nearby.

Annoyance from construction and alarms has also increased. Annoyance due to TV/music noise has increased in the last 20 years, while barking dogs annoy fewer people now.

Comparison with other cities

A recent UK study of environmental noise levels shows Melbourne and the UK have similar noise levels throughout the day and night.

According to social research, Victorians experience environmental noise impacts similar to those in other Australian states and overseas (Figure 3).

Response to noise impacts

Over one in six respondents (18 per cent) in the Social Survey say they have complained about noise to the authorities, with complaints made primarily about neighbour noise and road traffic noise. Police (60 per cent) and local government (25 per cent) receive the majority of complaints.

Over one in ten respondents say they have tried to solve the noise problem themselves. Of these, 63 per cent made changes to their homes or their habits and 37 per cent tried to directly or indirectly resolve the



problem through negotiation or demand. Changes to the home were the most effective. In these cases, such actions solved the problem in about half of the cases.

WHAT CAN YOU DO ABOUT NOISE?

If you have noisy neighbours, if appropriate, speak to the person who is causing the noise as soon as the problem arises, expressing your case honestly and respectfully. In many instances, they will be unaware that they are causing a problem and will quickly remedy the situation.

If talking to your neighbour does not resolve the problem, you do have other options. Action can be taken through the police or local council. The person affected can also take legal action.

Design and construction of your home is an important factor in the control of noise, especially with noise from traffic or aircraft. Measures such as improved glazing, insulation and the location of sleeping and living areas in relation to the noise source are important.

MEASUREMENT SURVEY FINDINGS

The Measurement Survey recorded noise levels at a range of sites to describe the current levels and patterns of environmental noise across Melbourne. This survey measured noise outside dwellings in residential areas, near commercial and industrial land uses and near main roads. Noise measurements were made for a period of approximately one week at each location. The results have been compared to international guidelines and previous studies.

Noise measurements can help to describe changes in a sound environment, be compared to noise standards or be used to develop policies. However, noise measurements do not judge if a sound is unwanted or equate to the reaction people have to a sound. For example, birdsong in the morning may be measured at a high decibel level but may not typically be considered noise.

For the measurement survey all sounds evident at a given location were measured, with no judgement as to whether the sounds were desirable or unwanted. It is in this context that 'environmental noise' is used in presenting the findings of the measurement survey.

Comparison to WHO guidelines

The World Health Organization (WHO) has developed *Guidelines for Community Noise* (1999)¹, which provide guideline values to protect the majority of people from being seriously annoyed during the daytime and to protect sleep at night. Comparison with these guideline values indicates the quality of Melbourne's sound environment.

Critical health effect	WHO guideline	Melbourne measured mean noise level	Percentage of measurement sites exceeding WHO guideline
Serious annoyance, daytime and evening	55 dB(A) ¹	54 dB(A)	34%
Sleep disturbance, night-time	45 dB(A) ²	47 dB(A)	56%

¹ Measured as long-term average, L_{Aeq}, 16 h

² Measured as long-term average (outside bedroom), L_{Aeq}, 8 h

The results show that, while the average noise level of sites across Melbourne is close to the WHO guidelines, there are a significant number of locations exceeding the guideline values.

The table above presents the percentages of measurement sites with noise levels above the WHO guideline. Measurement sites were located in residential areas near typical noise sources such as industry and roads, with some located in typical residential areas remote from any specific known source.

The percentages listed in the table above do not represent how many homes are located in quiet or noisy areas across Melbourne or how many homes are exposed to excessive noise. The measurement sites were not chosen to represent the spread of homes near noisy and quiet land uses across Melbourne. The number of homes where the noise level exceeds the WHO guideline is expected to be lower. For example, a recent national study² has estimated 16 per cent of Melbourne homes are exposed to road traffic noise at levels greater than the WHO guidelines. If noise from aircraft, trains and industries were considered, this figure would be higher.

¹ Berglund B, Lindvall T, Schwela D (eds), *Guidelines for Community Noise*. World Health Organization, Geneva, Switzerland. 1999.

² Brown AL, Bullen RB, Road Traffic Noise Exposure in Australian Capital Cities, *Acoustics Australia*, Vol. 31 April (2003), No. 1-11.

dB

The decibel (dB) is the unit used for sound level measurement. A logarithmic scale is used to easily represent the wide range of sound pressures to which the human ear responds.

dB(A)

Unit of sound level, in A-weighted decibels. The human ear is not equally sensitive to all frequencies of sound. The A weighting approximates the sensitivity of the human ear by filtering these frequencies. An A-weighted measurement is considered representative of average human hearing.

$L_{Aeq,T}$

Commonly referred to as the average level over time. It is based on the acoustic energy of the sound.

L_{A90}

Commonly referred to as the background noise. The L_{A90} represents the lowest 10 per cent of the sound levels measured over a given time period.

Land uses

The measurement sites were grouped according to land uses in the vicinity: residential near main road; predominantly residential; residential near commercial; and residential near industrial. In addition to the land use groups, the sites were categorised as those near main roads and not near main roads.

When comparing each land use, noise levels for the predominantly residential group are lower than for any other group. Dwellings located along main roads are exposed to higher levels of environmental noise (around 10 dB higher, or approximately twice as loud) than dwellings located in the vicinity of other kinds of noise-generating land use.

Times and days

The measurement survey found that both Saturday and Sunday mornings are significantly quieter than weekday mornings. For example, on Sunday mornings (6 am to 12 noon) the hourly L_{A90} level is up to 7 dB quieter than at the same time on weekdays (Figure 1).

Have noise levels in Melbourne changed over time?

In 1978 EPA released the *Melbourne Noise Survey*, which presented noise measurements in a range of locations across greater Melbourne. Since this time, Melbourne has grown and changed significantly. Some of the major changes are:

- the city's population has grown from 2.6 million to 3.6 million
- new suburbs have been established on the fringe of the city
- there has been an increase of more than 500,000 passenger vehicles on Melbourne's roads to more than 1.8 million
- the total distance traveled in vehicles each year has increased by around 10,000 million kilometres
- the size of Melbourne's metropolitan area has increased by nearly 10 per cent to cover about 8812 square kilometres
- there is a trend towards increased urban consolidation and redevelopment of inner and middle suburbs.

The Measurement Survey was conducted to describe the current quality of the sound environment and to estimate the change in noise over time since the 1978 survey. The table below presents the average noise levels from the 1978 and 2007 studies.

Descriptor	1978	2007
	Mean dB(A)	Mean dB(A)
$L_{Aeq,16hr}$ (day/evening)	55.9	54.3
$L_{Aeq,8hr}$ (night)	49.3	47.2

While noise levels appear to be slightly quieter in 2007, the results are similar enough that there is statistically no significant difference (Figure 2). Overall, analyses of the 2007 and 1978 measurement surveys show small changes in noise levels for some hours and some types of measurement, but no general trend of noise level increasing or decreasing. The results indicate success in reducing levels of industry noise and in reducing individual vehicle noise levels, helping to minimise noise associated with increasing traffic volumes.

How does Melbourne compare to other cities?

A recent study of environmental noise in England and Wales measured noise levels outside 1020 dwellings³. The results show Melbourne and the UK have similar noise levels throughout the day and night (Figure 3).

³ Wright P, Skinner C, Grimwood C, *The National Noise Incidence Study 2000 (England and Wales)*. BRE, Watford, United Kingdom. February 2002.

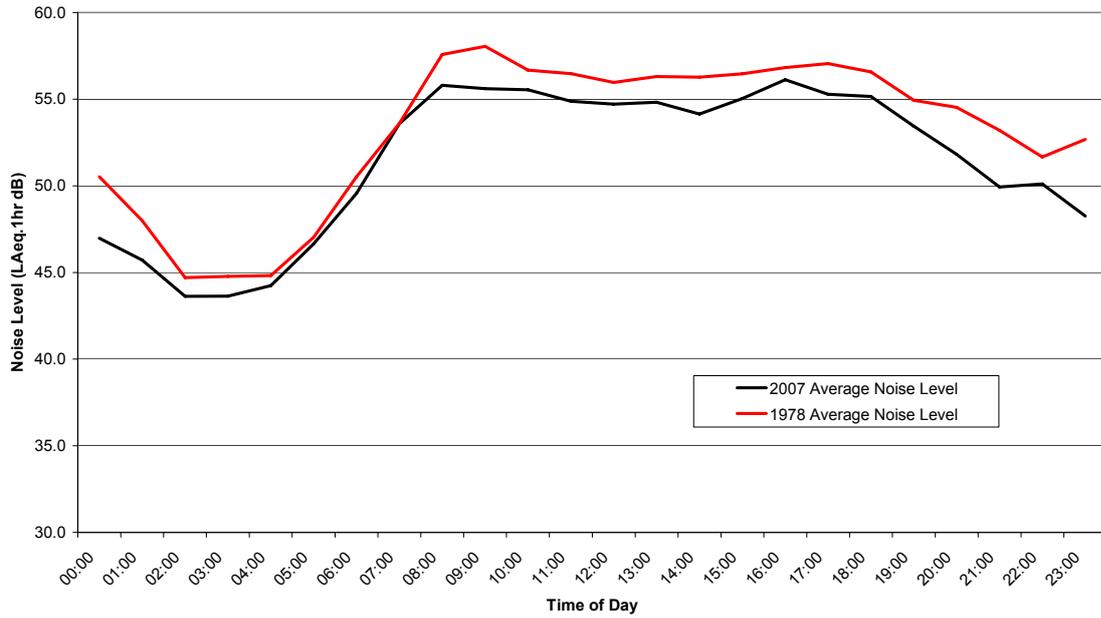


Figure 2: Average noise level for each hour on weekdays for 1978 and 2007

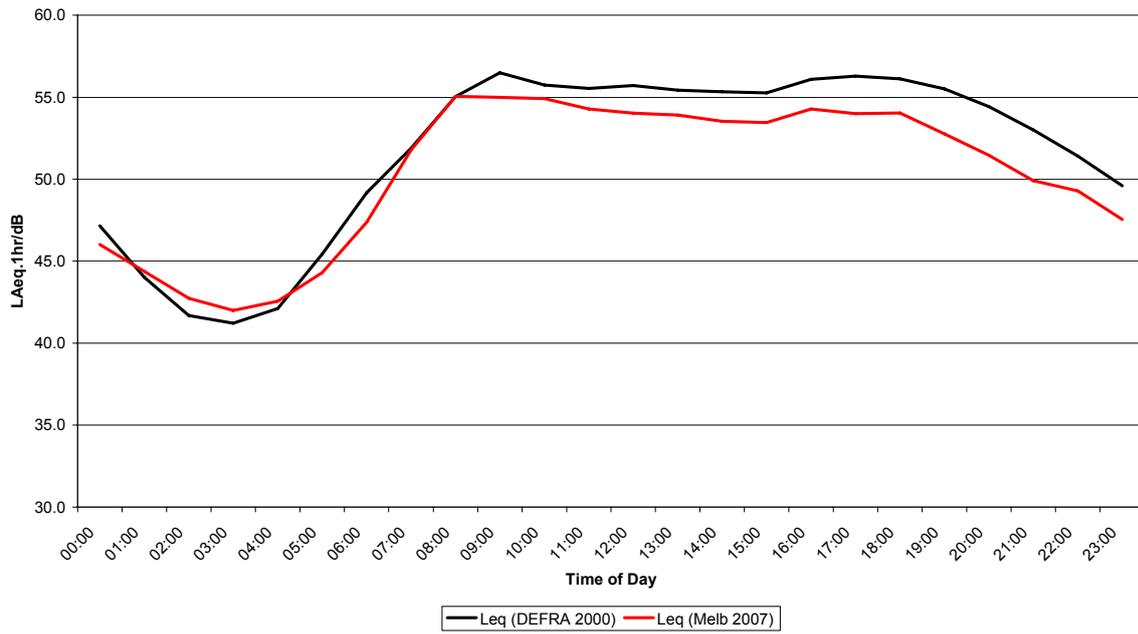


Figure 3: Average noise level for UK 2000 study and Melbourne 2007 study



SOCIAL SURVEY FINDINGS

The social survey asked 1213 residents across Victoria about the types of noise they hear and how they are affected in their homes.

Overall, almost half of respondents (49 per cent) have been disturbed at least once by a noise source over the last twelve months.

Noise affects sleep more than any other aspect of home life, with 23 per cent of respondents reporting sleep disturbance. 'Reading, relaxing and other quiet activities' (20 per cent) and 'spending time outdoors' (14 per cent) were other aspects of home life disturbed by noise.

Annoyance

The table below indicates the level of annoyance for the top five noise sources of concern for the Victorian community.

Other noise sources included in the survey were sports and recreation; music/entertainment venues; trains or trams; factories or industry; farms, forestry, agriculture, mining; shops or other businesses; and ports, boats and shipping. Less than three per cent of respondents were significantly annoyed by each of these sources. This could in part reflect the lower occurrence of these sources across Victoria.

Road traffic noise, noise from neighbours, audible alarms and construction noise are the four sources of noise most annoying to Victorians. The times when people are most commonly disturbed by these sources are at night over weekends.

When asked about traffic noise, respondents identified general traffic, trucks and noise from antisocial driving (such as hotted up cars, vehicles accelerating rapidly and engine revving) as the main types that were annoying.

TV, music and radio noise and noisy dogs are cited as the most annoying types of noise from neighbours. Neighbour noise has the most impact on people at the start of the weekday and at night on weekends.

Construction noise annoys more people at the start of the weekday than any other time. Noise associated with neighbours building or renovating their homes is identified as the main construction noise that respondents find annoying.

Intruder alarms and car alarms are the main types of audible alarms that respondents cited as annoying.

Helicopters and commercial airlines were the main sources of aircraft noise. Helicopters tend to affect people who live nearby, whereas commercial airliners are heard more broadly across the state. A low percentage of people hearing aircraft noise are annoyed by it.

In general, a similar percentage of people in metropolitan Melbourne and regional Victoria (rural and regional centers) reported hearing the main noise sources. However, a significantly higher proportion of respondents in metropolitan areas are annoyed (moderately to extremely) by the top four noise sources.

Noise exposure and level of annoyance

Source of noise	Proportion of respondents who hear the noise (%)	Proportion of respondents moderately to extremely bothered, annoyed or disturbed by noise source (%)
Road traffic noise	70	20
Neighbour noise	57	15
Audible alarms	48	8
Construction activities	34	8
Aircraft noise	61	6

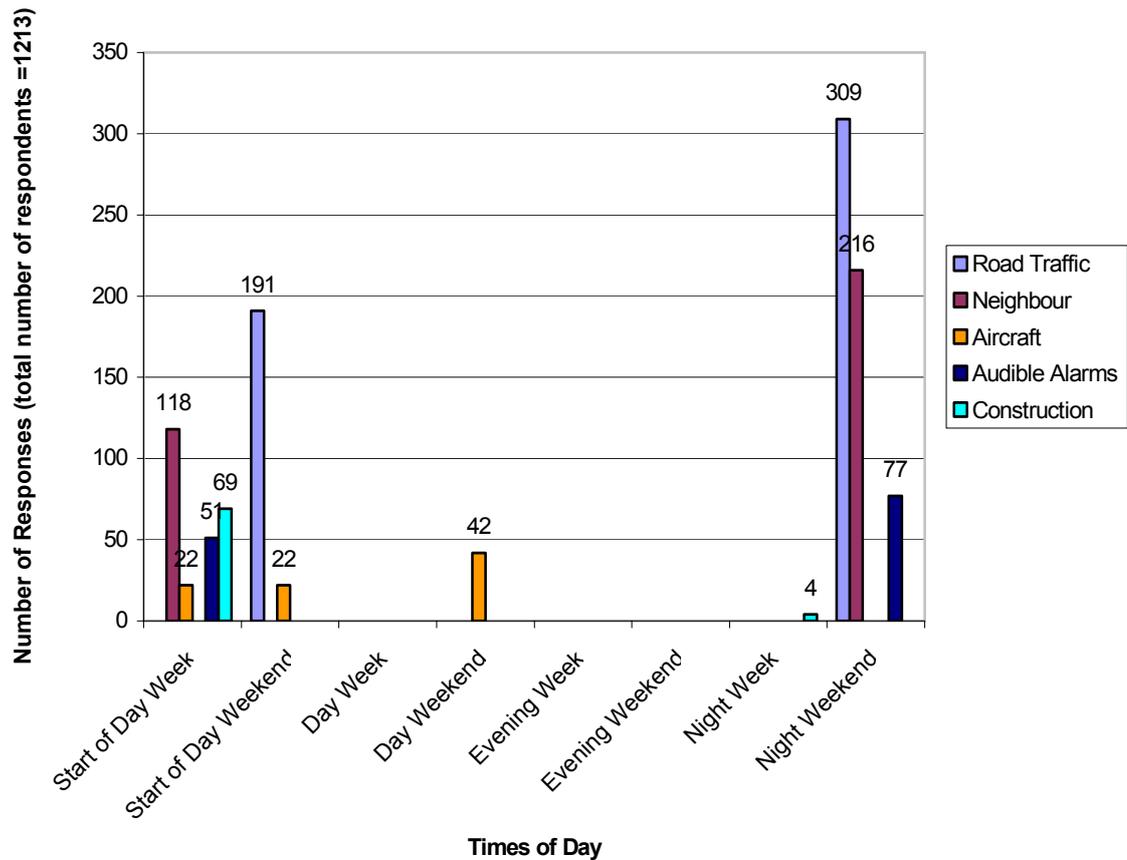


Figure 4: Times of day during the week and weekend when respondents reported being disturbed by noise sources

Comparison with other research

To best assess the survey findings, EPA has looked to past community surveys in Australia and current national and international research.

National Noise Survey 1986

The 1986 *Community response to noise in Australia* national noise survey⁴ was the first Australian study to assess the extent of disturbance resulting from many different environmental noise sources throughout the nation. It provides data on the overall impact of various types of noise on the general population.

The 2006 survey provides an opportunity to look at how Victorian communities' experience of noise has changed over the past 20 years.

Some of the categories of noise sources used in 1986 are different from those in the current study. For example, there was no overall category for neighbour noise, with the sources of barking dogs, lawn mowers,

noisy neighbours, neighbours' TV/music and parties being listed separately. However, the 1986 study report concluded that all domestic noise sources grouped together caused the most disturbance to the greatest number of people.

Overall in 1986, the noise categories that annoyed the greatest number of Australian residents were traffic noise and barking dogs. Traffic is now heard by more people and causes more widespread annoyance in Victoria. The level of annoyance from barking dogs is lower, with nine per cent of respondents mentioning barking dogs.

TV, music or radio is now the most commonly nominated annoying neighbour noise (11 per cent), compared to six per cent of people in 1986.

Other significant noise sources that can be compared with the 1986 survey are outlined below.

⁴ Australian Environment Council, *Community response to noise in Australia: results of the 1986 national noise survey*. Australian Government Publishing Service, Canberra, Australia. 1988.

Comparison of noise exposure and level of annoyance between 1986 and 2006

Source of noise	1986		2006	
	Heard (%)	Annoyance (%) [#]	Heard (%)	Annoyance (%) [#]
Traffic	47	15	70	21
Alarms	8	2	48	8
Construction	5	2	34	7
Aircraft	21	5	61	6
Railway (tram/train)	22	5	33	2

[#] Annoyance rating indicates percentage of respondents nominating an annoyance level of five or above on a scale of 0–10.

From the table it can be seen that the percentages of people hearing and being annoyed by alarms and construction have both increased since 1986. There has been a threefold increase in people hearing aircraft noise, but only a one per cent increase in annoyance. More people hear railway noise but the level of annoyance has decreased.

OTHER NATIONAL AND INTERNATIONAL COMMUNITY NOISE SURVEYS

Within Australia there have been two similar noise surveys undertaken in recent years: Brisbane Community Noise Survey (1998)⁵, and Noise Perception in South Australia (2004)⁶. Research in Hong Kong⁷, Canada⁸ and the UK⁹ also provides valuable insight into the scale and type of noise issues experienced internationally.

The 1998 Brisbane noise survey found noise significantly bothers or annoys 47 per cent of Brisbane's residents. The largest single noise source category of concern is transportation. Road and air traffic were dominant sources.

The South Australian study also found noise from road transport (28 per cent) and noise from neighbours

(22 per cent) were reported most often as a source of annoyance.

The international studies (Hong Kong, Canada and UK) found that road traffic noise bothered, annoyed or disturbed the most people. In Canada and the UK, noise from neighbours was reported as the next highest, whereas in Hong Kong construction noise and aircraft noise were reported as annoying more respondents than neighbourhood noise.

Overall, Victorians experience similar environmental noise impacts to other Australian cities and states, and to countries overseas.

ACKNOWLEDGEMENTS

EPA Victoria thanks the Melbourne residents who kindly volunteered their time and homes for the Measurement Survey and all of the Victorian respondents to the Social Survey.

⁵ Henry FD, Huson WL, *Brisbane Community Noise Survey 1998. Proceedings of Acoustics 2004*, Gold Coast, November 3–5 2004.

⁶ Nitschke Monika, Maynard Ted, Tucker Graeme. *Noise Perception in South Australia. Proceedings of the PHAA Conference*, Perth, September 25–27 2005.

⁷ Wong CL, Chau W, Wong LW, *Environmental Noise and Community in Hong Kong, Noise and Health 2002*, 4, 16, 65–69.

⁸ Michaud DS, Keith SE, McMurchy D, *Noise Annoyance in Canada, Noise and Health 2005*, 7, 27, 39–47.

⁹ Grimwood CJ, Skinner CJ, Raw GJ, *The UK National Noise Attitude Survey 1999/2000*. Noise Forum Conference. BRE, Watford, United Kingdom. May 2002.