



NZTA research summary

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# Community response to transport noise exposure in New Zealand

Environmental noise can harm human health and negatively impact people's daily activities at home, school and work and during leisure. The World Health Organization (WHO) 2018 environmental noise guidelines recommend maximum admissible noise levels to protect population health, classifying long-term annoyance, impaired wellbeing and self-reported sleep disturbance due to noise as health outcomes. Annoyance response is the most readily measurable and reliable indicator.

Environmental noise caused by transportation can cause a range of disturbance and annoyance reactions among individuals. The threshold at which individuals will be annoyed will vary depending on their expectations and sensitivity to noise. When combined at a population level, exposure response functions derived from the percentage of people reporting being highly annoyed for a given noise exposure level can be generated for different forms of transport and exposure response relationships can be compared to similar research.

## What we did

In 2016, a socio-acoustic survey was conducted in Auckland that considered the exposure response functions of people exposed to road-traffic and railway noise. The analysis showed that the percentage of people highly annoyed for a given noise exposure compared well with similar international studies, although in each case, the onset of annoyance occurred at marginally lower noise exposure levels.

The objectives of this second socio-acoustic study were to define and quantify the responses to short-term and long-term transportation noise exposure from road traffic, railways and aircraft. As well as including aircraft noise with study areas defined around Auckland, Rotorua and Queenstown Airports, the geographic scope was extended to include roads and railways outside Auckland. It was identified that there were no new or altered rail or airport projects to qualify as short-term study areas so only road-traffic noise was selected for short-term study areas.

This study commenced in 2021 and coincided with COVID-19 restrictions and the subsequent reduction in transportation activity within New Zealand. Socio-acoustic surveys were delayed until activity levels had returned to near normal levels and took place between September 2022 and January 2023. The 2016 survey questionnaire was used and expanded to include time-of-day factors, health and general wellbeing questions, interventions used to reduce annoyance and respondents' views of the noise source and those responsible for the relevant transportation infrastructure.

Sample populations for each mode of transport were identified, and potential respondents were randomly sampled within those population groups. A total sample of 2,212 completed the survey mostly on paper although some completed the survey online or by telephone. A sub-sample of 808 completed the road-traffic survey, 775 completed the railway survey and 629 completed the aircraft survey.

## What we found

### Road-traffic noise

Road-traffic noise was the most common source of noise annoyance for all respondents, regardless of which sample group they belonged to. When respondents were asked to identify which noise source currently bothers them the most when at home, 35% said they were most annoyed by road-traffic noise. This was also identified as the most annoying noise by 20% of the railway sample and 28% of the aircraft sample.

When asked about their level of annoyance with road-traffic noise, 20% of the sample reported being highly annoyed (rating 8 or more on the 0-10 annoyance scale). Of those highly annoyed with road-traffic noise, 65% were highly annoyed when inside their home with the windows open, 51% were highly annoyed even with their windows closed and 61% were highly annoyed when at home outside. Two-thirds (66%) of those highly annoyed found the noise annoying both during the week and in the weekends, especially in the evening and early morning (7pm-3am).

Highly annoyed respondents reported that road-traffic noise affected:

- their ability to relax outdoors (37%)
- their ability to get to sleep (31%)
- how much sleep they get (26%)
- how easily they become irritated (26%)
- how stressful or anxious they feel (26%)
- their ability to read, work or study from home (25%).

To try and minimise the noise or its impact, 24% of respondents and 45% of those highly annoyed said they keep their windows and doors closed when at home, while 12% of sample respondents and 30% of those highly annoyed said they spend less time outside and more time indoors.

Around 40% of those highly annoyed by road-traffic noise strongly disagreed that their local council (40%), freight operators (38%) or NZ Transport Agency Waka Kotahi (37%) were doing their best to reduce road-traffic noise affecting their neighbourhood.

### Railway noise

When railway sample respondents were asked to identify which noise source currently bothers them the most when at home, 9% said they were most annoyed by railway noise. To put this into perspective, more than double this proportion of the railway sample (20%) said they were more annoyed by road-traffic noise.

When asked about their level of annoyance with railway noise, only 7% of the sample reported being highly annoyed and 39% said they were not annoyed or bothered. Of those highly annoyed, 66% were highly annoyed when inside their home with the windows open and 42% with their windows closed. Two-thirds (65%) of those highly annoyed found the noise annoying both during the week and at weekends, especially late in the evening/early morning (7pm-3am).

Most of those highly annoyed with the noise reported that their bedroom faced the train tracks (81%), which also explains why the main impacts were to do with difficulty sleeping. In turn, 28% of those highly annoyed reported that noise affects how stressful or anxious they feel (28%) and how easily they get irritated (25%).

Just over one-third of those highly annoyed strongly disagreed that their local council (34%) or KiwiRail (38%) were doing their best to reduce railway noise affecting their neighbourhood.

### Aircraft noise

When asked to identify which noise source currently bothers them the most when at home, 30% of all aircraft sample respondents said they were most annoyed by aircraft noise. However, a similar proportion (28%) of aircraft sample respondents were most annoyed by road-traffic noise.

When asked specifically about their level of annoyance with aircraft noise, one in four of the sample (24%) reported being highly annoyed. Of those highly annoyed with aircraft noise, most were highly annoyed when inside their home with the windows open (81%) although 63% were also highly annoyed even with their windows closed. Aircraft noise was considered to be annoying both during the week and at weekends, particularly so in the evening and early morning (7pm-7am).

Many impacts were noted with regard to aircraft noise, particularly among those who were highly annoyed, including:

- their ability to relax outdoors (47%)
- their ability to listen to music, the radio or TV (46%)
- how easily irritated they get (44%)
- their ability to get to sleep (42%)
- how stressful or anxious they feel (35%)
- their health and wellbeing in general (35%)
- how much sleep they get (33%)
- their ability to read, work or study from home (33%).

To try and minimise the noise or its impact, 23% of respondents and 54% of those highly annoyed stated they currently keep their windows and doors closed when at home. Others said they spend less time outside when they are at home (9% of all people sampled and 23% of those highly annoyed), while 19% of those who are highly annoyed are planning to move from the area altogether.

Almost one-half of those highly annoyed by aircraft noise strongly disagreed that their local council (47%), airport company (45%) or airline/aircraft operators (49%) were doing their best to reduce the noise from aircraft affecting their neighbourhood.

## Conclusions

The findings of the study can be extrapolated to the New Zealand population exposed to transport noise on the basis that the wider exposed population have on average the same opinions as the sample population.

When compared to the WHO 2018 guidelines, the sampled New Zealand population is more sensitive to road-traffic noise, is less sensitive to railway noise and has similar sensitivities to aircraft noise. The study's findings for road-traffic and railway noise are comparable to the findings of the previous New Zealand study.

Socio-acoustic studies have consistently shown that a person's sensitivity to environmental noise varies considerably, that exposure response functions differ depending on the source and that attitudes are also related to non-acoustic factors. Differences could be due to changes in attitudes towards the source of noise, changes in noise exposure, differences in the cultures of those being surveyed, differences in study design, implementation or measurement or a combination of these factors. The WHO 2018 guidelines identify that, of the three sources of transportation noise, aircraft noise invokes the highest exposure response followed by road-traffic noise then railway noise. The studies used to inform the WHO 2018 guidelines also show that there are geographic variations in exposure response functions for the same source of noise, which include country/cultural differences.



RR 727: *Community response to transport noise exposure in New Zealand*.  
NZ Transport Agency Waka Kotahi research report.  
Available at [www.nzta.govt.nz/resources/research/reports/727](http://www.nzta.govt.nz/resources/research/reports/727)