MEMO

MARSHALL DAY Acoustics

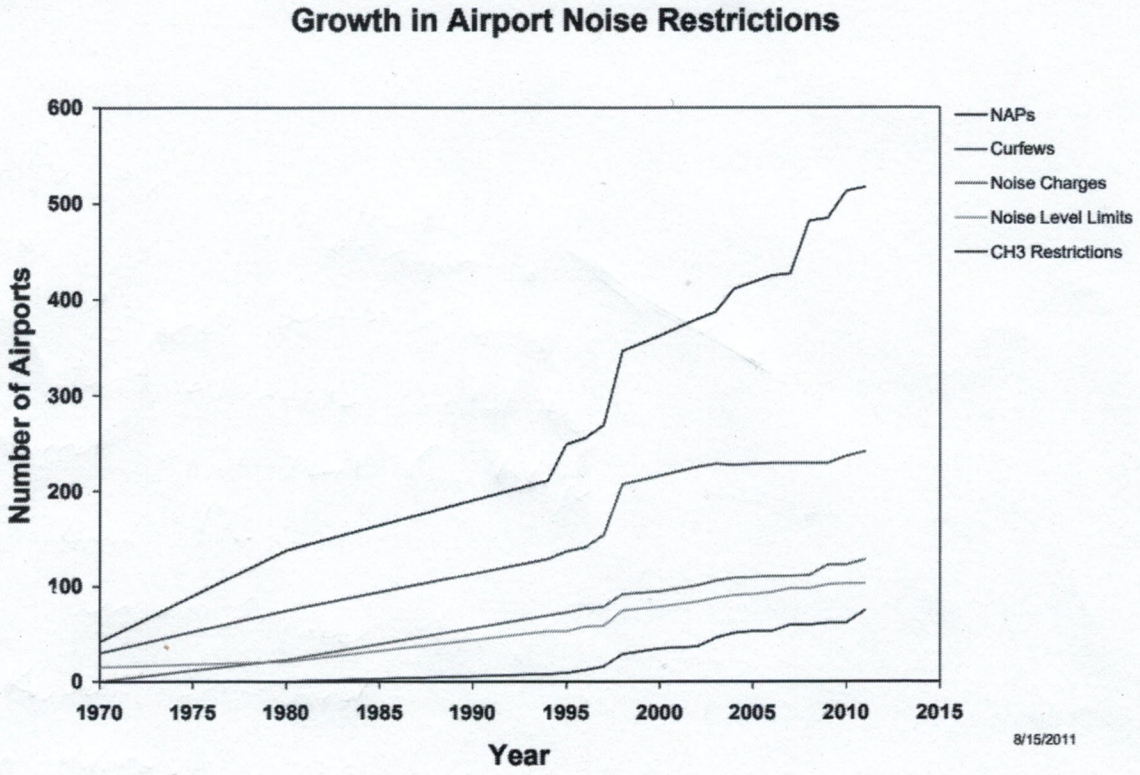
To:	Christchurch International Airport Limited	Document No.:	Mm 006		
		Date:	8 July 2022		
Attention:	Felicity Hayman	Cross Reference:			
Delivery:	By Email	Project No.:	20180806		
From:	Chris Day	No. Pages:	6	Attachments:	No
Subject:	The Enabling Act – Influence on People Affected by Aircraft Noise				

Introduction

This report considers the implications of the Resource Management (Enabling Housing Supply and Other Matters) Amendment Act 2021 (Enabling Act) in the context of the now remodelled and updated Air Noise Contours relating to noise effects from aircraft using Christchurch International Airport (the Airport).

We understand that Christchurch City Council (the Council) is required by the Enabling Act to implement higher density standards in residential zones across Christchurch. If these higher density controls are implemented for zones under the Christchurch Airport Air Noise Contours, there will be a significant increase in the number of people affected by aircraft noise with consequential impacts on airport operations due to complaints and community pressure groups.

Lack of appropriate land use planning around airports can cause significant numbers of people to be exposed to airport noise and has, in many cases, resulted in operational constraints on airports. The graph below from Boeing[1], shows the number of airport operational constraints has increased over time despite the fact that aircraft have become quieter due to advances in technology.



Note: NAP=Noise Abatement Procedures, CH3=Only aircraft with Chapter 3 Noise Certification or quieter can fly

[1] Available online at https://www.boeing.com/resources/boeingdotcom/commercial/noise/restrictions.pdf

Christchurch International Airport has mostly managed to avoid these restrictions by planning well into the future to avoid residential development within the noise contours. In Canterbury there is a strong regional and district planning framework controlling noise sensitive activities inside the Contours.

Aircraft noise inside the 50 dB L_{dn} contour causes adverse effects on people and this is not a desirable noise environment in which to increase residential density. Accordingly, it is preferable to avoid noise sensitive activities from locating in areas where they will experience adverse effects from aircraft noise from the outset. Sound insulation or other types of mitigation will not fully avoid adverse effects of noise on occupants. Where there is alternative land outside of the noise contours available to locate residential intensification, this should be preferred.

New Zealand Standard 6805 "Airport Noise Management and Land Use Planning"

The New Zealand Standard 6805 "Airport Noise Management and Land Use Planning" (the Standard) is intended to provide a consistent approach to noise planning around New Zealand airports. The Standard uses the "Noise Boundary" concept and provides minimum requirements to protect people from adverse effects of aircraft noise.

The Noise Boundary concept involves fixing an Outer Control Boundary (OCB) and a smaller Air Noise Boundary (ANB) around the airport. Between the ANB and the OCB, the Standard recommends that, as a minimum, new noise sensitive land uses should ideally be prohibited (and if the District Plan permits such uses, they should be provided with sound insulation). The overall approach set in the Standard is to first and foremost avoid noise sensitive activities within the OCB wherever possible.

Approach in Canterbury:

Local authorities around New Zealand have approached Noise Boundaries differently. Canterbury has historically used three contours to set land use planning rules – the ANB, the 55 dB L_{dn} Air Noise Contour, and the 50 dB L_{dn} Air Noise Contour (which is used as the OCB). Christchurch District has thus far taken a 'mid-way' position to setting planning rules under the Contours for existing residential areas, whereby the Christchurch District Plan contains restricted densities in conjunction with additional sound insulation requirements within the 55 dB L_{dn} Contour, and with a prohibition on any new noise sensitive activities within the ANB. This recognises that there is a level of historical established residential zoning which comes with legitimate expectations for development.

Outside of the existing residential areas, a buffer has been successfully maintained around Christchurch International Airport whereby less noise sensitive land uses (such as rural, industrial and commercial activity) have been directed to establish in the areas affected by airport noise, and noise sensitive land uses (such as residential activity) have been largely avoided. Many other New Zealand airports have not been as fortunate. In the cases of Auckland and Wellington, local authorities have tended to implement less stringent land use planning rules, as in most cases the Standard arrived too late to prevent residential encroachment close to those airports. Wellington airport operates according to a curfew which prohibits night-time flights over these residential areas, to avoid the noise effects that would arise.

Community response to aircraft noise:

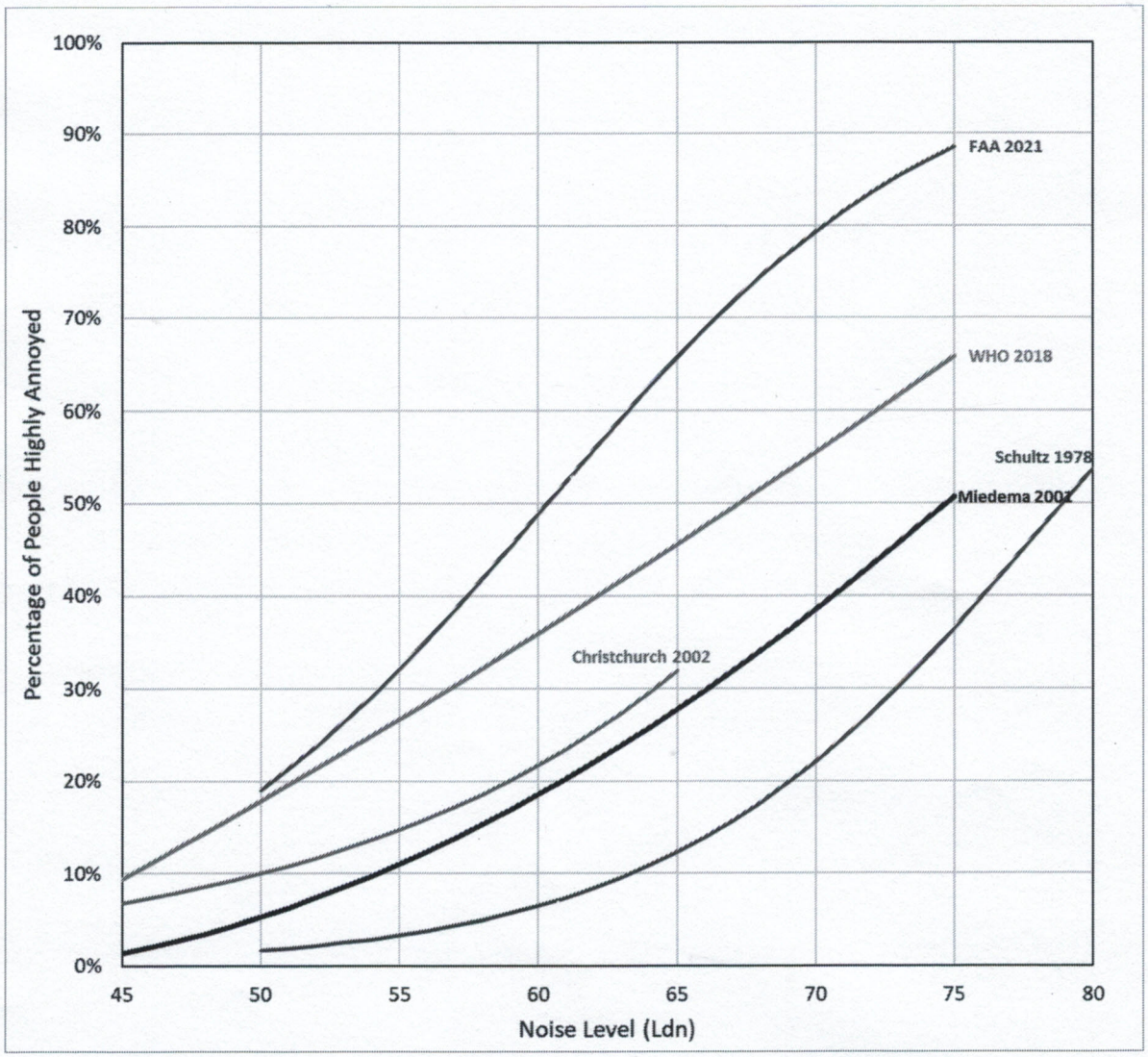
There is no hard and fast "cut off" threshold at which noise effects from airport operations are felt. The general understanding to date has been that the adverse effects from airport noise below 45 dB L_{dn} are not significant (although new research shows this view may have altered). Above 65 dB L_{dn} the adverse effects are generally agreed to be serious. Clearly there is not a sudden point at which noise effects 'switch' in — it is a sliding scale. This sliding response is shown by the research into community response to noise, which we explain below.

In our opinion, there are adverse effects from aircraft noise inside the OCB (50 dB L_{dn}). While the adverse effects are less than, for example, they are at 65 dB L_{dn} they are nevertheless real. Generally, the adverse effect we are speaking about is noise annoyance which can be caused by a number of things such as sleep disturbance, speech interference and psychological reactions to aircraft noise.

For the past 20 years the Miedema and Oudshoorn 2001 dose-response curve has been widely used as the best amalgamation of research into aircraft noise annoyance. This curve shows that between 50 and 55 dB L_{dn}, 5% to 11% of people were found to be highly annoyed by aircraft noise. A Christchurch study undertaken by Taylor Baines and the Christchurch City Council in 2002 showed higher levels of annoyance with 10% to 15% of the population 'Highly Annoyed' between 50 and 55 dB L_{dn}.

More recent research shows that levels of annoyance have increased markedly among populations living around airports. The two most prominent studies, published by the WHO in 2017 and the FAA in the United States in 2021, yielded much higher levels of annoyance where 18% to 32% of people were found to be highly annoyed by aircraft noise between 50 and 55 dB L_{dn} as shown in Figure 2 below.

Figure 2: Community response to aircraft noise



Those findings suggest that, in order to minimise the number of highly annoyed people, a level of 45 dB L_{dn} is required which is 10 dB lower than recommended by the Standard, and 5 dB lower than the current OCB that exists at Christchurch.

Both the Christchurch data and the latest overseas data confirm that, at 50 dB L_{dn} and above, some of the population will be highly annoyed by aircraft noise. This is not a desirable noise environment in which to locate additional residential development (or intensification) if it can be easily avoided. The latest overseas studies confirm that community tolerance to aircraft noise is likely reducing, not increasing.

If greater levels of intensification than permitted in the operative District Plan were allowed to occur in the residentially zoned areas inside the 50 dB L_{dn} Air Noise Contour, then an increase in the number of people highly annoyed would be expected to occur. Planning rules that allow for high density residential activity to establish as of right are, by design, intended to increase the number of households and people who reside in existing residential zones. This will then expose more people to adverse effects from aircraft noise.

It is therefore appropriate, from an acoustics perspective, to prevent development and intensification within the 50 dB L_{dn} Air Noise Contour in order to protect the health and amenity of the community, as well as the operations of CIA.

Insulation and Land Use Planning Controls:

Some advocates of residential development in areas affected by aircraft noise have historically suggested that sound insulation fitted to noise sensitive dwellings is sufficient on its own to avoid the adverse effects of noise on occupants and to protect the interests of the Airport.

Marshall Day has long taken the view that this assertion, that sound insulation is all that is required to prevent reverse sensitivity effects, is incorrect for several reasons:

The level of sound insulation required in the 50 to 55 dB L_{dn} area is provided by a standard house. No additional construction techniques or materials are required in this area to achieve 'appropriate' indoor sound levels. However, amenity will still be compromised outside therefore it is appropriate to have land use controls in the form of density restrictions to ensure that the number of people exposed to this noise level is kept low.

Recent research shows that 18% to 32% of the population is typically highly annoyed by aircraft noise in this environment, even though they can close their windows and achieve 'WHO satisfactory' noise levels inside.

1. Houses located in the 55 dB L_{dn} area are likely to need to keep their windows closed to reduce internal noise levels, particularly at night when the background noise levels are lower, and aircraft noise could cause sleep disturbance. Three possible scenarios follow:
    a. Windows are kept closed, resulting in an unsatisfactory level of fresh air;
    b. A ventilation system or air-conditioning system is installed to improve air quality, with significant cost; or
    c. Windows are left open resulting in an unsatisfactory noise environment.

    Each of these scenarios is likely to result in complaints from the residents.
2. Sound insulation does not deal with the outdoor noise environment and New Zealanders generally enjoy an 'outdoor' type of lifestyle. Again, an unsatisfactory external noise environment is a potential source of residential complaint.

As discussed above, the New Zealand Standard refers to sound insulation as a fall-back mitigation measure and, in our view we prefer to 'avoid' the effects of airport noise ahead of mitigation. Insulation is a much less desirable method to avoid the impacts of airport noise when compared to adequate land use planning.

Density controls are able to minimise the number of people exposed to the adverse effects associated with aircraft noise. Uncontrolled development of noise sensitive uses around an airport can unnecessarily expose additional people to high levels of noise and can constrain, by public pressure as a response to noise, the operation of CIA.

If land is available elsewhere in the Christchurch district for new residential development (or intensification), in our view, it is not sensible planning to allow new noise sensitive activities inside 50dB L_{dn}.

Remodelling the noise contours for Christchurch Airport:

In 2018 Christchurch International Airport Limited (CIAL) began the process to update the Operative Noise contours. Airbiz and Marshall Day Acoustics (MDA) were engaged to prepare updated noise contours for inclusion in the CRPS and District Plans, with data and input provided by Airways New Zealand (Airways) and

by CIAL in consultation with airlines. The new noise contours are referred to as the "Updated Noise Contours". The details of this process are contained in a combined report by Airbiz, MDA, CIAL and Chapman Trip titled "2021 Christchurch International Airport Expert Update of the Operative Plan Noise Contours".[2]

The outcome of this study is that a number of modelling input parameters have changed since the previous 2007 noise modelling exercise that produced the Operative Noise Contours. The resultant Annual Average Updated Noise Contours are a different shape compared with the Operative Noise Contours. The Annual Average Updated 50 dB L_{dn} Contour is shown in Figure 3 below.

Estimate of the increased number of people affected by Aircraft Noise

We understand that there are 5,438 land parcels located under the Updated 50 dB L_{dn} Contour (pink shading shown in Figure 3 below).

Taking a crude estimate, and assuming that 20% of those parcels[3] are developed to accommodate three residential units per site, this could translate to 2,175 additional residential dwellings[4].

Using the Christchurch City average residential occupancy density or 2.5 persons per dwelling, this translates to an additional 5,437 people exposed to the effects of aircraft noise. Most of these houses are located just inside the 50 dB L_{dn} contour where the WHO community annoyance results (Figure 2 above) suggest that approximately 20% of the occupants would be highly annoyed by aircraft noise. This suggests an additional 1,087 people (approximately) are likely to be highly annoyed by aircraft noise if the proposed intensification happens within the 50 dB L_{dn} Updated Noise Contours.

---

[2] Available online at: https://www.christchurchairport.co.nz/globalassets/about-us/sustainability/noise/noise-contours/2021_cial_expert_update_of_the_operative_plan_noise_contours.pdf.

[3] Christchurch City Council engaged the Property Group to assess feasible development capacity once the MDRS are in place. We understand that they calculated feasible capacity as approximately 20% of the theoretical capacity. The 20% estimate used for the purposes of this report was therefore selected at a high level based on Property Group's assessment.

[4] Assuming there is currently one dwelling per site, redevelopment to accommodate three would mean an additional two dwellings per site above the current situation.

Figure 3: CIA Updated Noise Contour and Relevant Residential Zones In Christchurch City