

MEMO

Project:	Linton Quarry	Document No.:	Mm 002		
To:	Hirock c/o Good Earth Matters	Date:	29 May 2023		
Attention:	Emma Hilderink-Johnson	Cross Reference:			
Delivery:	By email	Project No.:	20210382		
From:	Jon Farren	No. Pages:	3	Attachments:	No
Subject:	Truck vibration				

This memo provides general information about the vibration levels generated by trucks on roads. In summary, much of the commonly used criteria focus on the potential for damage to occur to buildings and our experience is that truck vibration at dwellings is significantly below these levels.

VIBRATION CRITERIA

In lieu of any national guidance, the following criteria are commonly adopted to assess vibration in New Zealand:

- Building damage – German Standard DIN 4150-3:2016 “*Structural Vibration - Effects of Vibration on Structures*”; and
- Human response – British Standard BS 5228-2:2009 “*Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*”.

Both of these Standards provide vibration criteria in terms of the Peak Particle Velocity (PPV). The criteria are summarised in the following sections.

Building Damage Criteria

The DIN 4150-3:2016 Standard provides conservative guidance designed to prevent any damage (even superficial) to buildings. It sets criteria for both long- and short-term vibration that apply in all axes at the building foundation or in horizontal axes at the highest floor adjacent to a façade wall.

The Standard defines ‘short-term’ vibration as ‘vibration which does not occur often enough to cause structural fatigue and which does not produce resonance in the structure being evaluated’. Common sources include blasting, drop-hammer piling, dynamic consolidation. Long-term vibration is defined as all other vibration types not covered by the short-term vibration definition. The criteria are summarised in Table 1.

Table 1: Summary of building damage risk vibration criteria from DIN 4150-3:2016

Type of structure	Short-term			Long-term	
	PPV at the foundation by frequency, mm/s			PPV at highest floor, mm/s	PPV at highest floor, mm/s
	1 – 10 Hz	10 – 50 Hz	50 – 100 Hz		
Commercial/Industrial	20	20 - 40	40 - 50	40	10
Residential/School	5	5 - 15	15 - 20	15	5
Historic or sensitive structures	3	3 - 8	8 - 10	8	2.5

The Standard states that “experience has shown that if [the guideline values] are complied with, damage will not occur. Exceeding the [guideline values] slightly does not necessarily lead to damage”.



Human Response Criteria

Annex B of BS 5228-2:2009 provides guidance that primarily relates to vibration from construction activities, but is also a useful reference for human response to vibration in residential environments. These criteria are summarised in Table 2.

Table 2: Guidance for human response to construction vibration in BS 5228-2:2009, Annex B

Vibration (PPV)	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Comparing these values with those derived from the DIN Standard above, it is clear that people are likely to perceive, and potentially adversely respond to, vibration levels that are significantly lower than those which may cause superficial building damage (such as cracking in paint or plasterwork). Additionally, people are generally more sensitive to vibration at frequencies higher than those which cause building damage.

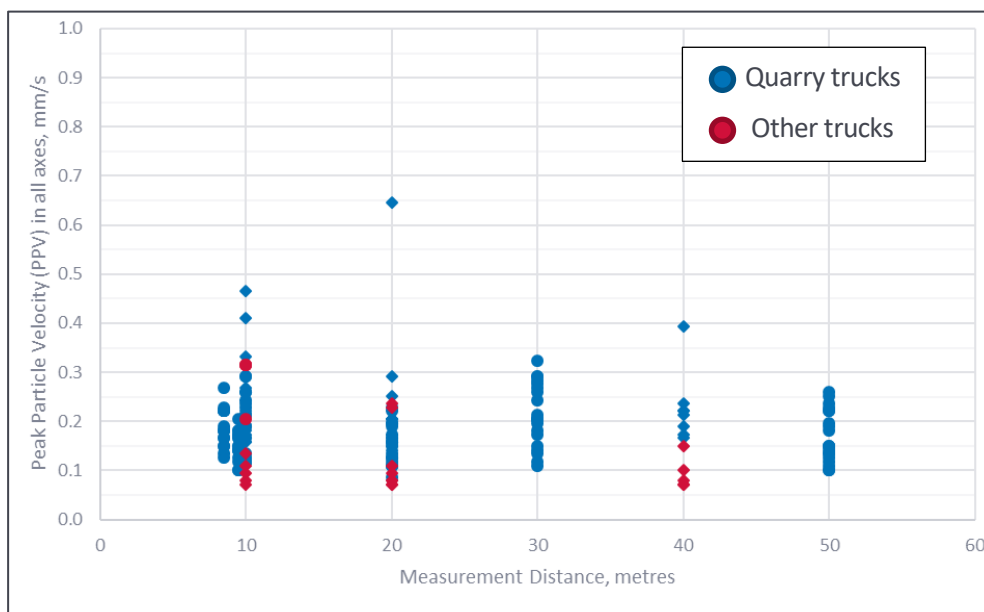
MEASURED VIBRATION LEVELS

Vibration from trucks travelling on roads is typically generated when the truck encounters a pothole, corrugation or other irregularity. In other words, vibration should not be a significant feature of well-maintained roads.

Our experience with similar quarrying and mining projects is that vibration generated by trucks associated with the activity using the public road network does not result in any different level of effects to the traffic otherwise using those roads.

We have surveyed vibration from heavy vehicles at various distances from public roads leading to other quarries. The results are shown in Figure 1 below.

Figure 1: Heavy traffic vibration measurements on local roads



Note measurement distance is from road centreline.

Most measurements are below 0.3 mm/s which is the level that vibration is generally considered as perceptible in residential environments. All measurements are below 1mm/s which is the threshold for complaint and substantially below 5 mm/s threshold for structural damage.