

Appendix I: Ground Vibration

II Introduction

Ground vibration from land use activities can range in effect from structural damage to buildings, which is a relatively extreme level of vibration, to disturbance of sleep and the reduction of amenity as a result of people being able to perceive vibration. Ground vibration standards should be set in terms of human perception rather than in relation to the structural implications for buildings. This ensures that the amenities of any area are not unreasonably compromised.

Ground vibration may be continuous or transient or intermittent. Continuous vibration is vibration that remains uninterrupted over a given time period. Transient and intermittent vibration involves the rapid build-up of vibration then decay (sometimes in cycles), or strings of vibration incidents.

Isolated, high-magnitude vibration events, such as blasting, which occur intermittently or transiently and only a few times a day present special concerns and accordingly must also be addressed and managed. Human response to impulsive vibration from blasting can be wide ranging, with the same event being imperceptible to some persons, while causing nuisance to others. By setting an appropriate standard for impulsive vibration from blasting, the amenity values are maintained at a reasonable level. Any impulsive vibration from blasting in excess of the standards set, may be considered through the resource consent process and the standards set out in this rule will be used as a guideline in setting conditions.

Research has shown that human perception levels for vibration are as follows:

- Vibration level less than 0.5mm/s – imperceptible (threshold of perception)
- Vibration level of 0.5mm/s to 2.0mm/s – slightly perceptible (barely noticeable)
- Vibration level greater than 2.0mm/s – distinctly perceptible (noticeable).

Vibration levels in excess of 5.0mm/s have the potential to compromise amenity values.

Vibrations from blasting are usually intermittent and of short duration. Measurement in buildings of vibrations from blasting is inappropriate, because of the different response of each building to the ground vibration, and accordingly measurement of vibration will be taken in the ground.

Blasting events should be designed in such a way as to comply with the standards set. However, the Council recognises that the prediction of the maximum ground vibration experienced from any particular blast event is dependant upon distance from source, ground conditions, and design of the blasting pattern. A complex relationship exists between these factors, and in considering adherence to the standard, the Council will have regard to the following factors:

- (a) the total number of blast events occurring as a result of the activity
- (b) the time at which blasting occurs
- (c) the time between blast events
- (d) the amount by which the standard has been exceeded
- (e) the actions taken to prevent recurrence of breach of the standard
- (f) quality management systems that are in place to control blast design and the resulting vibration levels.

All ground vibration measurements shall be taken at or within the boundary of any residential property not owned by the agency responsible for creating the vibration. For the Rural and Country Living Zones only, measurements shall be taken at the notional boundary of any property that is not owned by the party responsible for generating the vibration. (The notional boundary means a line 20 metres from and parallel to the facade of the dwelling or building used for residential accommodation, or the legal boundary, where this is closer to the dwelling or building).

The vibration frequency band width that is to be monitored is nominally 2hertz to 80hertz but this may be varied by the Council (particularly at the low-frequency end of the range) on a case-by-case basis to reflect the capability of commercially available vibration monitoring systems.

Where vibration generated by a land use activity exceeds the conditions below, then the activity will require a discretionary activity resource consent.

I2 Conditions for Vibration and Blasting

- (a) All blasting shall be in accordance with Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001.
- (b) The measurement of ground vibration from blasting shall be carried out in accordance with "Controls on intended detonation and deflagration of class 1 substances" of the above Hazardous Substances Regulations.
- (c) All blasting shall be restricted to between 8am and 4pm Monday to Saturday, except where blasting is necessary because of safety reasons.
- (d) Blasting shall be confined to 5 occasions per day, and no more than 2 of those blasts involve the use of more than 500 kg of explosives, except where necessary for safety reasons.
- (e) Where blasting is irregular and the occupiers of neighbouring sites could be alarmed, they shall be advised of pending blasts, at least one hour before any such blast.
- (f) When blasting, no residential building outside the designated use zone is subject to a ground vibration leading to more than 10.0mm/s peak particle velocity and no commercial or industrial building outside the designated use zone is subject to a ground vibration leading to more than 25.0mm/s peak particle velocity.
- (g) Every blast shall be recorded with particular attention to details of charge weight and delay practice. Monitoring using reliable and appropriate methods representative of all blasts, at varying distances and various sites of different sensitivity, shall be carried out to ensure that clause (f) above is complied with. Blast records and monitoring results shall be made available to the Council on request.

See Appendix N (Construction Noise) for standards for air blast noise from using explosives.