FACT SHEET

Vibration associated with construction

When Watercare builds or maintains infrastructure in the ground such as pipes, the use of heavy machinery can generate vibrations.

All construction work generates some vibration and in Auckland the standards applied by Auckland Council require that vibration is limited to levels where there is a low risk of cosmetic damage (cracking of finishings and plastered joints) as well as disturbance to residents.

How is vibration felt and measured?

The human body is highly sensitive to vibration and will feel movement at much lower levels than will typically cause structural damage.

Vibration is generally measured in terms of peak particle velocity in units of millimetres per second (mm/s) corresponding to:

Human perception	**0.3 mm/s**
Moderate discomfort for extended periods	**2-3 mm/s**
Disturbance to people	**5 mm/s**
Small risk (‹5%) of cosmetic cracks forming	**12 mm/s**
Small risk (‹5%) of structural damage	**›50 mm/s**
Damage to foundations, retaining structures and in-ground services	**›100 mm/s**

To provide a context the levels of vibration typically caused by the following domestic activities are listed below (as detected at about five metres distance)

Slamming of a door within five metres	**1-3 mm/s**
Person jumping on timber floor	**2-5 mm/s**
Removal / delivery truck operating in driveway	**2-3 mm/s**
Heavy furniture being shifted	**3-8 mm/s**
Washing machine out of balance	**10-12 mm/s**

Vibration reduces rapidly with increased distance from the source. For example, a medium-heavy excavator operating immediately adjacent to a house may generate vibration that causes some disturbance but not damage whereas at more than 10 metres the vibrations will be much more tolerable.

The above list of domestic activities is compared below with vibrations generated by typical construction equipment operating in the road reserve at a distance of about 10 metres from a house. Vibrations at the house itself will be less due to the rapid decay vibrations through the ground.

Diggers, loaders, trucks etc.	**1-3 mm/s**
Sheet pile driving (soft to hard ground)	**4-8 mm/s**
Vibrating rollers and compactors	**4-10 mm/s**

The vibration levels are dependent on the size of machinery, methods of construction used and the ground conditions encountered. A number of factors come into the construction planning and methodology to minimise vibration where possible. For example, one of the factors could be to assess whether smaller machinery is appropriate in areas that are particularly sensitive to vibration. A number of factors are considered such as if smaller equipment is sufficient to undertake the job and also how much longer the project would take with smaller equipment. Prolonged construction projects can also have greater effects in other areas such as roads and prolonged noise. This is just one of the factors considered in the management plan, and the decision is not made lightly.

Monitoring vibration

In most cases vibration monitoring is not required during construction. However, depending on ground conditions and the proximity to buildings a pre-construction survey and/or monitoring may be undertaken as a precaution to protect both Watercare and property owners interests during the project.