



Vibration



Amplitude-the distance that a vibrating particle travels from a fixed point.

Frequency-the number of wave cycles that occur in 1 second.

Hertz (Hz)-the unit by which frequency is measured.

Displacement-a measure of the distance that a vibrated particle travels from its original position.

Velocity-the rate of speed at which particles move in inches per second or millimeters per second.

Acceleration-the rate of change in velocity with respect to time.

Another community annoyance related to noise is vibration. As with noise, vibration can be described by both its amplitude and frequency. Amplitude may be characterized by displacement, velocity, and/or acceleration. Typically, particle velocity (measured in inches or millimeters per second) and/or acceleration (measured in gravities) are used to describe vibration.

Vibration can be felt outdoors, but the perceived intensity of vibration impacts are much greater indoors, due to the shaking of the structure. Some of the most common sources of vibration come from trains and/or transit vehicles, construction equipment, airplanes, and large vehicles. Several land uses are especially sensitive to vibration, and therefore have a lower vibration threshold. These uses include, but are not limited to, concert halls, hospitals, libraries, vibration-sensitive research operations, residential areas, schools, and offices.

Table 3, Human Reaction to Typical Vibration Levels, presents the human reaction to various levels of peak particle velocity. Typical construction vibrations fall in the 10 to 30 Hz range and usually occur around 15 Hz. Traffic vibrations exhibit a similar range of frequencies. However, due to their suspension systems, city buses often generate frequencies around 30 Hz at high vehicle speeds. It is more uncommon, but possible, to measure traffic frequencies above 30 Hz.

**Table N-3:
Human Reaction to Typical Vibration Levels**

Vibration Level Peak Particle Velocity (inches/second)	Human Reaction
0.0059-0.0188	Threshold of perception, possibility of intrusion
0.0787	Vibrations readily perceptible
0.0984	Continuous vibration begins to annoy people
0.1968	Vibrations annoying to people in buildings
0.3937-0.5905	Vibrations considered unpleasant when continuously subjected and unacceptable by some walking on bridges.

Source: Caltrans, 1992

Policies:

- N 15.1 Restrict the placement of sensitive land uses in proximity to vibration-producing land uses. (AI 105)
- N 15.2 Consider the following land uses sensitive to vibration:
 - Hospitals;
 - Residential Areas;



- Concert Halls;
- Libraries;
- Sensitive Research Operations;
- Schools; and
- Offices

N 15.3 Prohibit exposure of residential dwellings to perceptible ground vibration from passing trains as perceived at the ground or second floor. Perceptible motion shall be presumed to be a motion velocity of 0.01 inches/second over a range of 1 to 100 Hz.