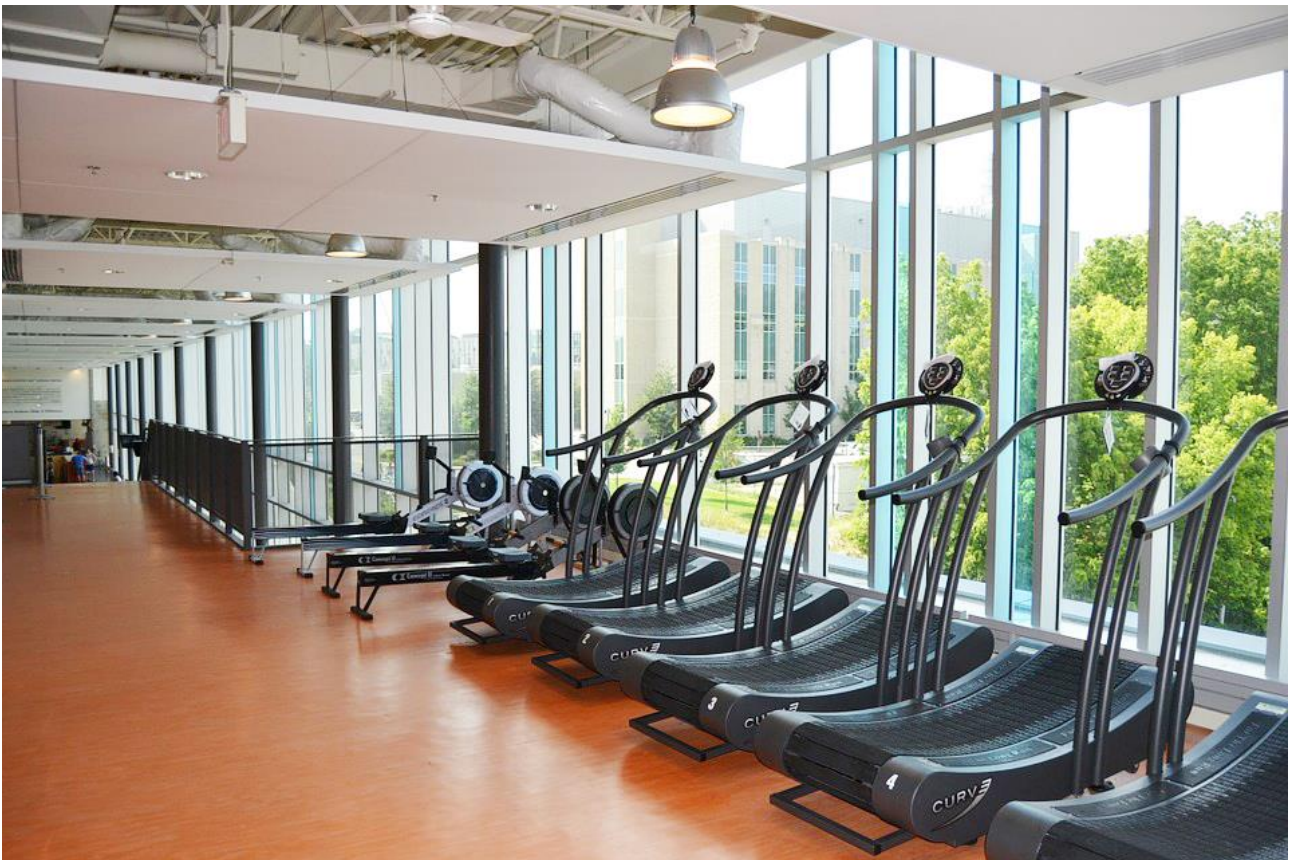


Controlling vibration in residential & commercial building



Vibration within buildings can impact people's health, productivity, disturb sensitive equipment and even cause structural damage. As urban density increases, residential and commercial developments are increasingly built near vibration sources and so the design of buildings must account for the control of vibrations.

Vibrations that affect buildings can be produced by a variety of sources. Common scenarios where vibration in buildings can be a problem include:

- Developments in proximity to railway and underground railway lines
- Gym operations in multi-use buildings
- Plant equipment operation in noise sensitive properties
- Buildings in proximity to sources of construction activities, such as excavation, piling, tunnelling and vibratory compaction

What are building vibrations?

Vibrations are regular recurring motions of a given frequency and amplitude that move through a solid material like the ground or the structure of a building, typically masonry, wood or steel.

Vibrations are usually caused by an event or source, such as a passing train, plant equipment in operation or an impact from a weight being dropped in a gym. Vibrations can generally be perceived in two ways: as surface resonant motion or as re-radiated noise.

- Surface resonant motion can be felt as surface movement such as during an earthquake, an impact drop or rumble from an underground train.
- Re-radiated noise occurs when levels of groundborne vibration give rise to vibration of building surfaces, that in turn cause an audible rumbling sound in the frequency range from 25 Hz to 250 Hz by radiation to the air inside a room.

What standards provide guidance on building vibrations?

The British Standards which offer guidance for vibration measurement are:

- BS 6472-1:2008 – Guide to evaluation of human exposure to vibration in buildings.
- BS 5228-2:2009 – Code of practice for noise and vibration control on construction and open sites.

Whilst BS 6472-1:2008 and BS 5228-2:2009 relate to levels of vibration perceived in buildings, i.e. vibration perceivable by touch, there is no standard on the assessment of re-radiated noise as a result of vibration.

The most relevant guidance in the UK is the Association of Noise Consultant's 'ANC guidelines – Measurement & Assessment of Groundborne Noise & Vibration (Red Book)'. This includes methods of assessment of re-radiated noise and sets out recommended criteria to work towards in different building types.

Re-radiated noise from vibration sources is a growing concern and assessment and mitigation advice services are becoming a common request from developers and Local Authorities. Re-

radiated noise from vibration can be a risk to occupant health and wellbeing and should be considered during early design stages and designed out as best as possible.

How is building vibration is measured?

Vibration is typically measured across a frequency range in the same way as airborne sound and is weighted based on our sensitivity to different frequencies (i.e. A-weighting for decibel). Vibration is weighted based on whether it is for vertical vibration displacement, denoted by W_b , or horizontal vibration displacement, denoted by W_d .

Vibration is measured using either accelerometers or geophones depending on the magnitude and desired characteristics to be recorded. Geophones are used to measure high-impact sources, such as construction activities which can indicate the likelihood of damage to buildings. Accelerometers are used for more sensitive applications, typically employed to derive re-radiated noise levels from measured vibration levels.

Measurements should take place at least on the boundary of the site, on the proposed building line or in the affected room. Ideally, measurements at the source should also be taken to determine the transmission loss due to propagation, which can be complex to calculate when vibration travels through multiple mediums, i.e. for a railway noise a simplified path from source to receiver is via the ground/soil, building foundations, building structure and internal finishes.

Mitigation

Consideration of vibration impact should be given as early in the project development as possible to ensure the most cost-effective solutions are available. The assessment of vibration and re-radiated noise is essential in determining the feasibility of developments in proximity to vibration sources and those that give rise to vibration.

Specialist vibration assessments

To assess the level of vibration a building or its occupants may be exposed to, a vibration assessment is required. Anderson Acoustics provide vibration monitoring, surveys, assessments and reports on all aspects of building vibration that may be a risk to your proposed or existing development. We help you incorporate measures that effectively reduce vibration in accordance with BS 6472 and other relevant standards and industry guidance.