31 October 2019

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Goodman Property Services (Aust) Pty Ltd
Level 17
60 Castlereagh Street
Sydney NSW 2000

Attention: Stephanie Partridge

Dear Stephanie

Oakdale West Industrial Estate
SSD 7348 - MOD 1
Operational Noise Impacts

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Goodman Property Services (Aust) Pty Ltd (Goodman) to assess the operational noise impacts of the Oakdale West Industrial Estate (Oakdale West), located in Kemps Creek.

Goodman obtained Development Consent SSD 7348 from the Department of Planning, Industry and Environment (DPIE) for the Oakdale West 'Concept Proposal' and 'Stage 1 Development' on 13 September 2019. The Concept Proposal comprises a 'Master Plan' to guide the staged development of Oakdale West and core development controls that will form the basis for design and assessment of future development applications for the site.

The design of the development has been updated as part of a modification (MOD 1) to the Development Consent SSD 7348.

This letter presents a review of the operational noise emissions for the MOD 1 design of the development and compares the predicted noise levels to the noise criteria for the site, as specified in the Development Consent SSD 7348.

1 MOD 1 Design Plans

The MOD 1 design includes the following modifications from the approved design:

- Pad height of Lots 2A and 2B raised by around 2.0 m to a height of 66.5 m
- Pad height of Lot 2E raised by around 0.5 m to a height of 67.3 m
- Pad height of Lots 2F and 2G raised by around 2.0 m to a height of 69.8 m
- Changes to retaining walls to suit change in pad levels
- Changes to the base height of noise barriers in Precinct 2 to suit changes in pad levels (the height of noise barriers above their base does not change, ie a 5 m high noise barrier is still 5 m above ground).

No other areas of Oakdale West have been modified by the MOD 1 design. Proposed traffic volumes for Oakdale West are not affected by the MOD 1 design.

All assumptions in this assessment are consistent with the assumptions for the approved development operational noise impact assessment.

The approved design is shown in **Figure 1**, and the MOD 1 design is shown in **Figure 2**.

Figure 1 Approved Design Plans

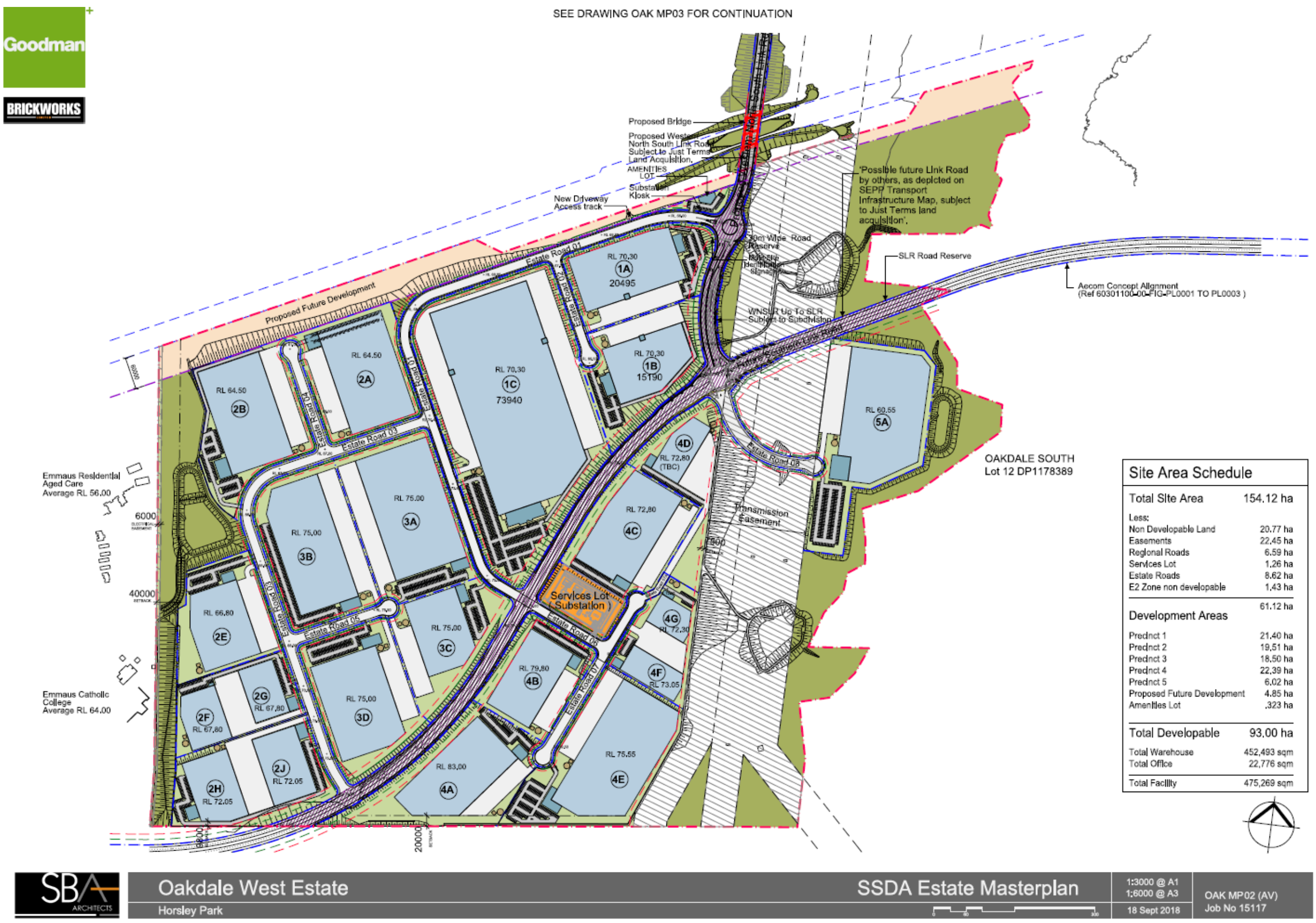
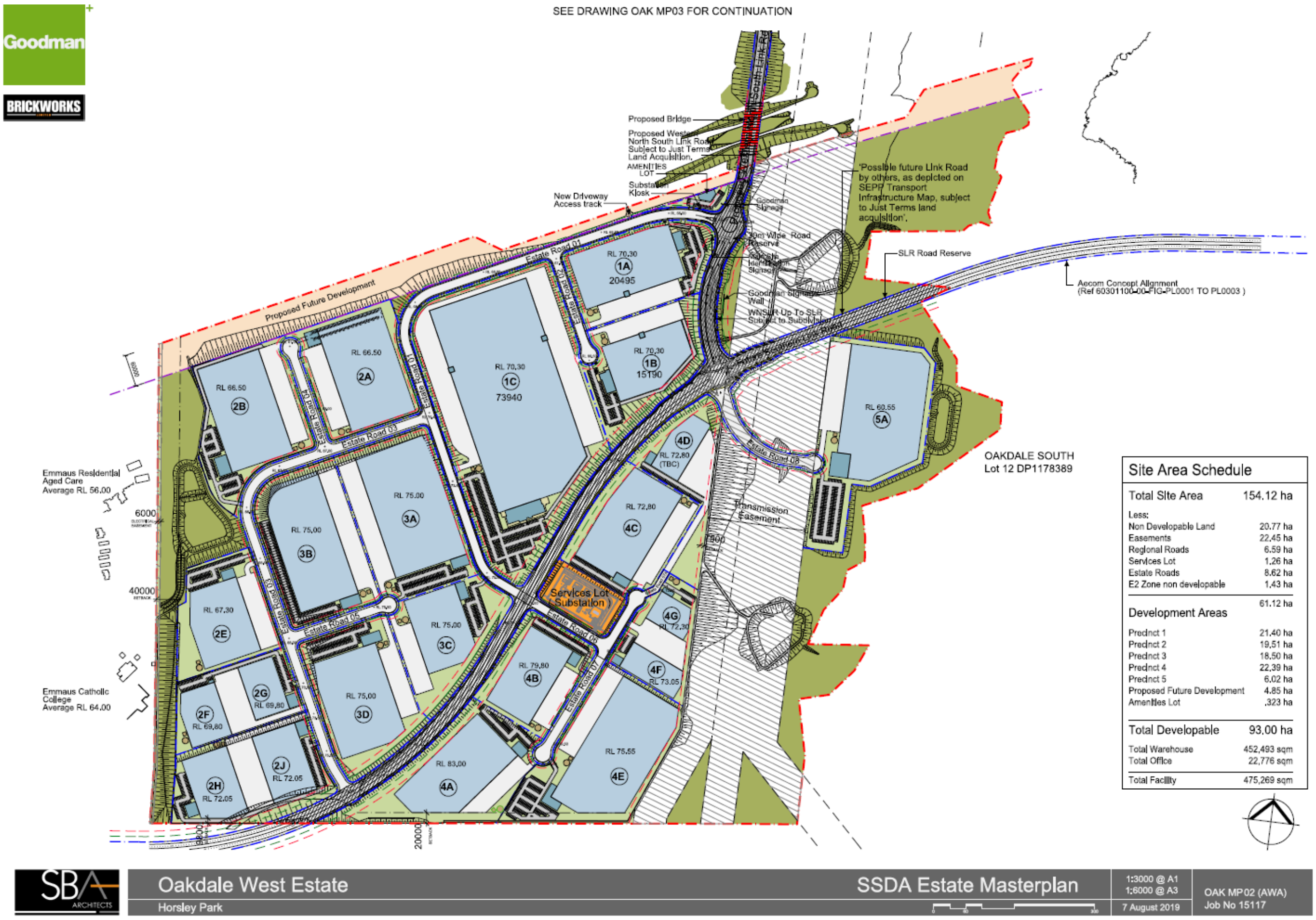


Figure 2 MOD 1 Design Plans



2 Operational Noise Criteria

The operational noise criteria applicable to Oakdale West are specified in Conditions B18 and B19 of the Development Consent SSD 7348. Conditions B18 and B19 are reproduced below:

B18 The Applicant shall ensure the Development does not exceed the noise limits in Table 3 at the receiver locations N1, N2, N3, N4 and N5 shown on the plan in Appendix 5.

Table 3: Noise Limits dB(A)

Location	***Day***	***Evening***	***Night***	
	LAeq(15 minute)	***LAeq(15 minute)***	***LAeq(15 minute)***	***LA1(1 minute)***
N1 Emmaus Village Residential	*44*	*43*	*41*	*51*
N3 Kemps Creek – nearest residential property	*39*	*39*	*37*	*47*
N4 & N5 Kemps Creek – other residences	*39*	*39*	*37*	*47*
N2 Emmaus Catholic College (school)	***When in use:*** *35 (internal)*			

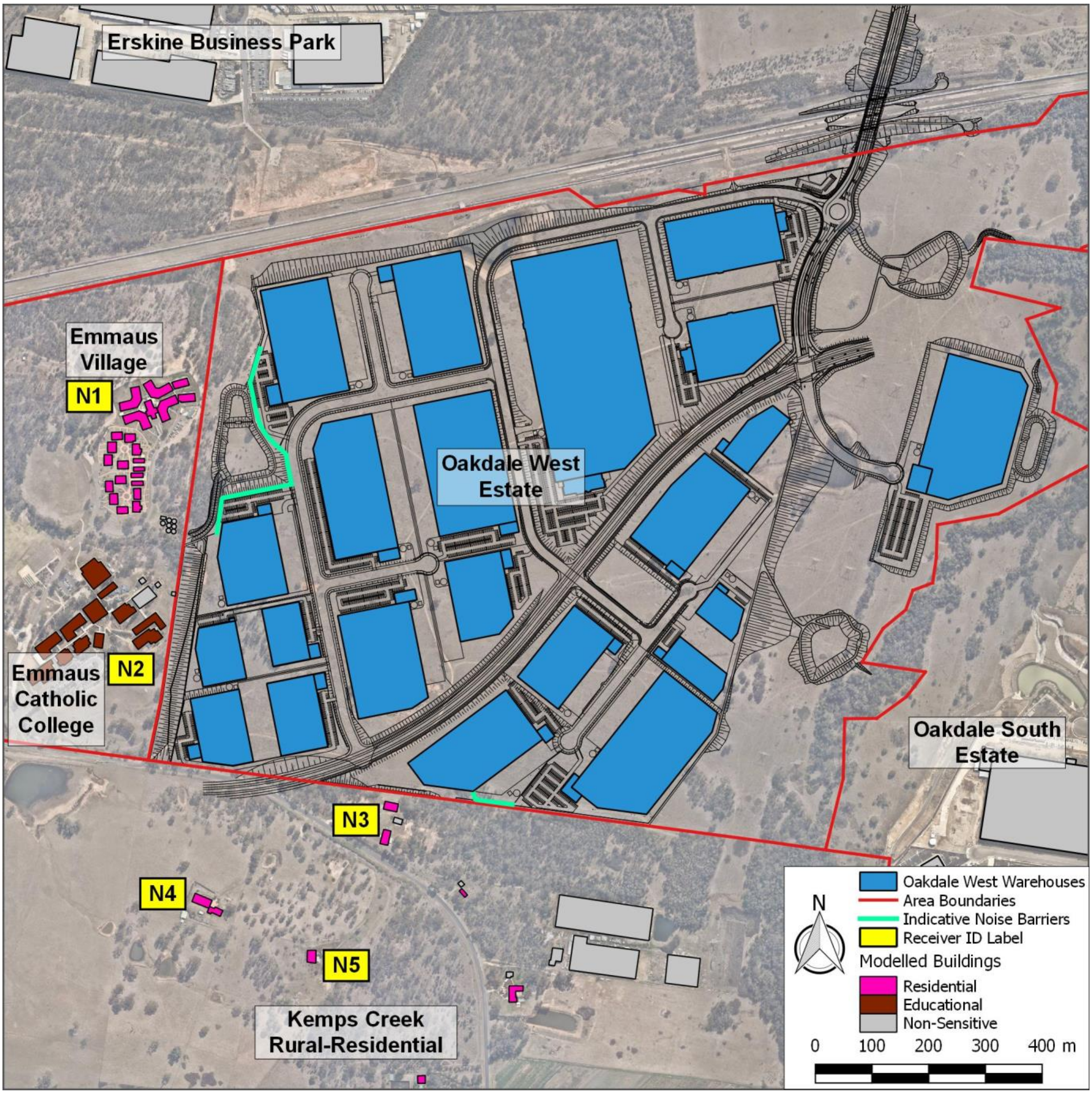
Note: Noise generated by the Development is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the Noise Policy for Industry (EPA 2017).

B19. The noise limits in Table 3 do not apply to receiver N3 if the Applicant has a Noise Agreement with the relevant landowner to exceed the noise limits, and the Applicant has provided written evidence to the Planning Secretary that an agreement is in place.

It is understood that a Noise Agreement with receiver N3 has been submitted to DPIE. As such, the criteria in Condition B18 of the Development Consent SSD 7248 are not applicable at receiver N3.

The locations of receivers N1, N2, N3, N4 and N5 are shown in Appendix 5 of the Development Consent SSD 7348. These locations are shown in **Figure 3**.

Figure 3 Receiver Locations



3 Noise Impact Assessment

Operational noise from the development was modelled using the SoundPLAN noise model prepared for the Oakdale West EIS. This model was updated with the MOD 1 design changes as outlined in **Section 1**.

The predicted operational noise levels for the MOD 1 design are compared to the applicable criteria and the predicted operational noise levels for the approved design in **Table 1**.

Table 1 Predicted Operational Noise Levels

Receiver	Period (weather)	Assess-ment	LAeq(15 minute) Noise Level (dBA)					Change in Predicted Noise Level (dB)
			Criteria	Approved Design	MOD 1 Design			
				Predicted	Predicted	Exceedance	Compliance[3]	
N1 – Emmaus Village Residential	Day (standard)	15-min	44	35	33	-	Yes	-2
	Eve (standard)	15-min	43	35	33	-	Yes	-2
	Night (noise-enhancing)	*15-min*	*41*	*35*	*32*	-	*Yes*	*-3*
N2 – Emmaus Catholic College (school)	When in use	1-hour	45 (external)[1]	37	36	-	Yes	-1
N3 – Kemps Creek – nearest residential property	Day (standard)	15-min	39	40	40	N/A[2]	N/A[2]	0
	Eve (standard)	15-min	39	40	40	N/A[2]	N/A[2]	0
	Night (noise-enhancing)	*15-min*	*37*	*40*	*40*	N/A[2]	N/A[2]	*0*
N4/N5 – Kemps Creek – other residences	Day (standard)	15-min	39	34	33	-	Yes	-1
	Eve (standard)	15-min	39	34	33	-	Yes	-1
	Night (noise-enhancing)	*15-min*	*37*	*35*	*34*	-	*Yes*	*-1*

Note 1: Criteria for N2 is specified as an interior noise level. For the purpose of this assessment a conservative inside to outside correction of +10 dBA has been applied to the criteria for N2 in order to assess the external noise predictions against the criteria. An inside to outside correction of +10 dBA is typical of a building with open windows.

Note 2: As per Condition C19 of the Development Consent SSD 7348, the noise criteria does not apply at N3 (refer to **Section 2**).

Note 3: **Bold** text indicates an exceedance of the criteria.

Operational noise emissions from the development are predicted to comply with the relevant criteria at the surrounding sensitive receivers.

Noise levels are predicted to above the criteria at N3, which is consistent with the approved project, however as per Condition C19 of the Development Consent SSD 7348, the noise criteria do not apply at this residence (refer to **Section 2**).

The MOD 1 design is predicted to result in lower noise levels than the approved project at receiver N1 (-2 dBA to -3 dBA) and receivers N2 and N4/N5 (-1 dBA). The increase in pad heights in Precinct 2 raises the height of the noise barriers and warehouses on these lots relative to the adjacent receivers. This provides increased shielding from these structures to other areas of Oakdale West which aren't being adjusted by MOD 1 (such as the estate roads), which results in lower predicted noise levels.

Overall, the predicted operational noise impacts from the MOD 1 design are generally consistent with the approved design.

I trust that this letter covers your requirements.

Yours sincerely

J. Ridgway

JOSHUA RIDGWAY
Senior Consultant

Checked/
Authorised by: MR

APPENDIX A

Acoustic Terminology

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x 10^{-5} Pa.

2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3. Sound Power Level

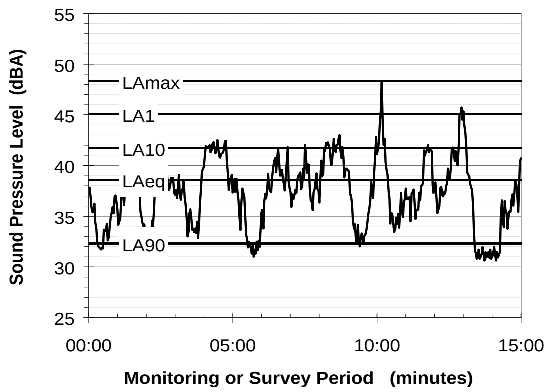
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

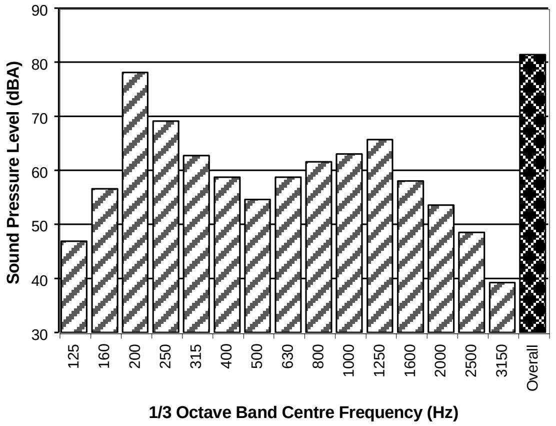
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

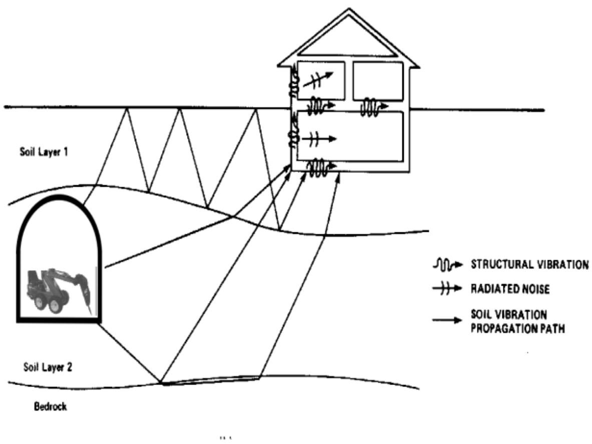
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.