



Sound is typically defined as the auditory response resulting from pressure waves in the air caused by the vibration of a surface. Fundamentally, a sound can be defined by the frequency (pitch) of the longitudinal waves and the loudness.

Frequency is determined by the number of pressure variation cycles within a second. This is inversely proportional to the wavelength of the sound waves, which is defined as the distance travelled by a pressure wave during one cycle. The loudness, defined by level of the pressure change caused by the waves, is related to the amplitude of the sound wave. Both these aspects are illustrated below.

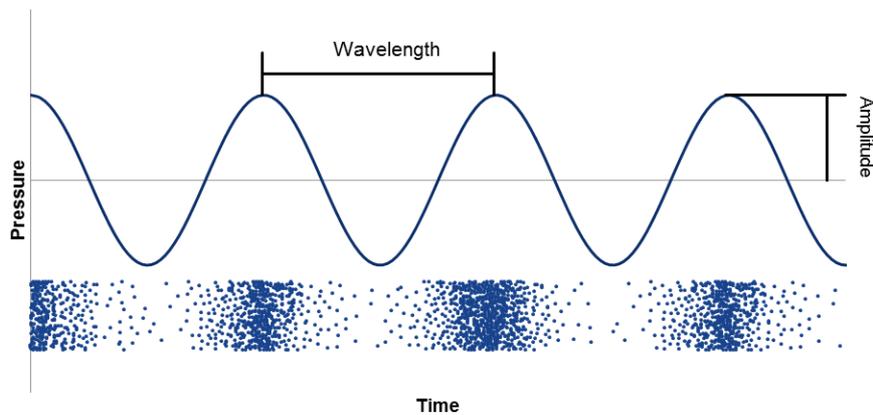


Figure 1 - Illustration of sound pressure wave compression and rarefaction

In essence, higher frequency sounds, such as bird song or whistles, have a shorter wavelength, whilst deep sounds, such as drums or truck engines, have longer wavelengths. This is illustrated below, along with a representation of louder and quieter sounds.

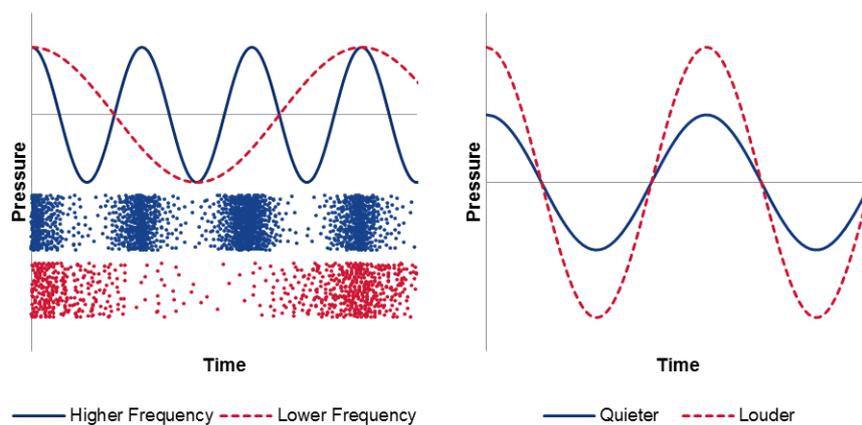


Figure 2 - Illustration of variation in sound properties

SOUND AND DISTANCE

Sound pressure reduces proportionally with distance to the source, effectively a 6 dB reduction in sound pressure level can be considered every time the distance is doubled.

Table 1 - Attenuation of sound with increase in distance

Distance from Source (m)	Small Sound Source Sound Pressure Level (dB)	Extended Sound Source Sound Pressure Level (dB)
1	60	60
2	54	57
3	50	55
4	48	54
5	46	53
10	40	50

SOUND PROFILES

In a similar way to a musical chord being generated by the simultaneous playing of notes of single frequencies, the majority of sounds generated by objects, such as vehicles, or by human speech, will contain a number of frequencies at different volumes combined. As a result, a sound profile can be measured for a source sound in order to show the sound pressure across the frequency range.

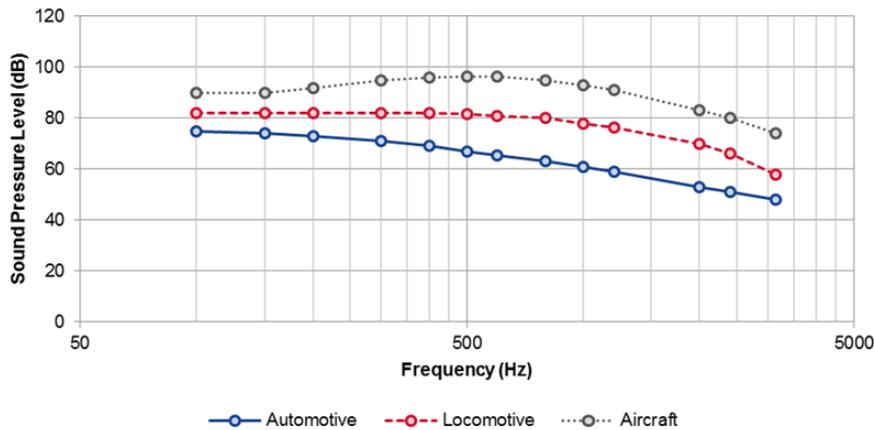


Figure 3 - Typical sound pressure level profiles for varying noise sources

When considering that in any single location, there are likely to be multiple sound sources which vary throughout the day depending on traffic volumes where roads are considered, or working hours where factories may be the source noise.