Table 1 — Typical range of structural response for various sources

Vibration forcing function	Frequency range Hz	Amplitude range µm	Particle velocity range mm/s	Particle acceleration range m/s^2	Time characteristic	Measuring quantities
Traffic road, rail, ground-borne	1 to 80	1 to 200	0,2 to 50	0,02 to 1	C/T	pvth
Blasting vibration ground-borne	1 to 300	100 to 2 500	0,2 to 500	0,02 to 50	T	pvth
Pile driving ground-borne	1 to 100	10 to 50	0,2 to 50	0,02 to 2	T	pvth
Machinery outside ground-borne	1 to 300	10 to 1 000	0,2 to 50	0,02 to 1	C/T	pvth/ath
Acoustic traffic, machinery outside	10 to 250	1 to 1 100	0,2 to 30	0,02 to 1	C	pvth/ath
Air over pressure	1 to 40				T	pvth
Machinery inside	1 to 1 000	1 to 100	0,2 to 30	0,02 to 1	C/T	pvth/ath
Human activities						
a) impact	0,1 to 100	100 to 500	0,2 to 20	0,02 to 5	T	pvth/ath
b) direct	0,1 to 12	100 to 5 000	0,2 to 5	0,02 to 0,2		
Earthquakes	0,1 to 30	10 to 10^5	0,2 to 400	0,02 to 20	T	pvth/ath
Wind	0,1 to 10	10 to 10^5			T	ath
Acoustic inside	5 to 500					

Key

C = continuous, T = transient } (simplified categories, see **3.1** and **3.2**)

pvth = particle velocity time history

ath = acceleration time history

NOTE 1 The ranges quoted are extremes but indicate the values which may be experienced and which may have to be measured (see also note 3). Extreme ranges of amplitude of displacement and frequency have not been used to derive particle velocity and acceleration.

NOTE 2 The frequency range quoted refers to the response of buildings and building elements to the particular type of excitation. It is indicative only.

NOTE 3 Vibration values within the ranges given may cause concern. There are no standards which cover all varieties of building, condition and duration of exposure, but many national codes associate the threshold of visible effects with peak particle velocities at the foundation of a building of more than a few millimetres per second. A significant probability of some damage is linked to peak particle velocities of several hundred millimetres per second. Vibration levels below the threshold of human perception (see ISO 2631-2) may be of concern in delicate and industrial processes.

7 Position and fixing of transducers

7.1 Positions

7.1.1 *General*

The proper characterization of the vibration of a building requires a number of positions of measurement which depend upon the size and complexity of the building.

Where the purpose is to monitor with regard to imposed vibration, the preferred position is at the foundation, a typical location being at a point low on the main load-bearing external wall at ground floor level when measurements on the foundations proper are not possible.

Measurements of vibration response generated by traffic, pile-driving and blasting, especially at a great distance, show that the vibration may be amplified within the building and in proportion to the height of the building. It may, therefore, be necessary to carry out simultaneous measurements at several points within the building. Simultaneous measurements on the foundation and the ground outside will serve to establish a transfer function.

Where a building is higher than 4 floors (≈ 12 m), subsequent measuring points should be added every 4 floors and at the highest floor of the building.