Table 1.1 Ground vibration limits for human comfort (blasting)

Blasting		
Category	**Type of operations**	**Peak component particle velocity (mm/s)**
Sensitive site*	Operations lasting longer than 12 months or more than 20 blasts	5 mm/s for 95 per cent blasts per year 10 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply
Sensitive site *	Operations lasting for less than 12 months or less than 20 blasts	10 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply
Occupied non-sensitive sites, such as factories and commercial planes	All blasting	25 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply for sites containing equipment sensitive to vibration, the vibration should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation

Other		
Category	**Period**	**Peak component particle velocity (mm/s)**
Residential	Night-time	0.2 mm/s
	Daytime	0.3 mm/s mm/s
Offices	When occupied	0.6 mm/s
Occupied non-sensitive sites, such as factories and commercial premises	When occupied	2.5 mm/s

mm/s = millimetres per second

a A ‘sensitive site’ includes houses and low-rise residential buildings, theatres, schools, and other similar buildings occupied by people.

Table 1.2 BS 7385-2 Transient vibration guide values for cosmetic damage

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	**15 Hz and above**
1	Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structure. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Notes:
1 Values referred to are at the base of the building.

2 For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.

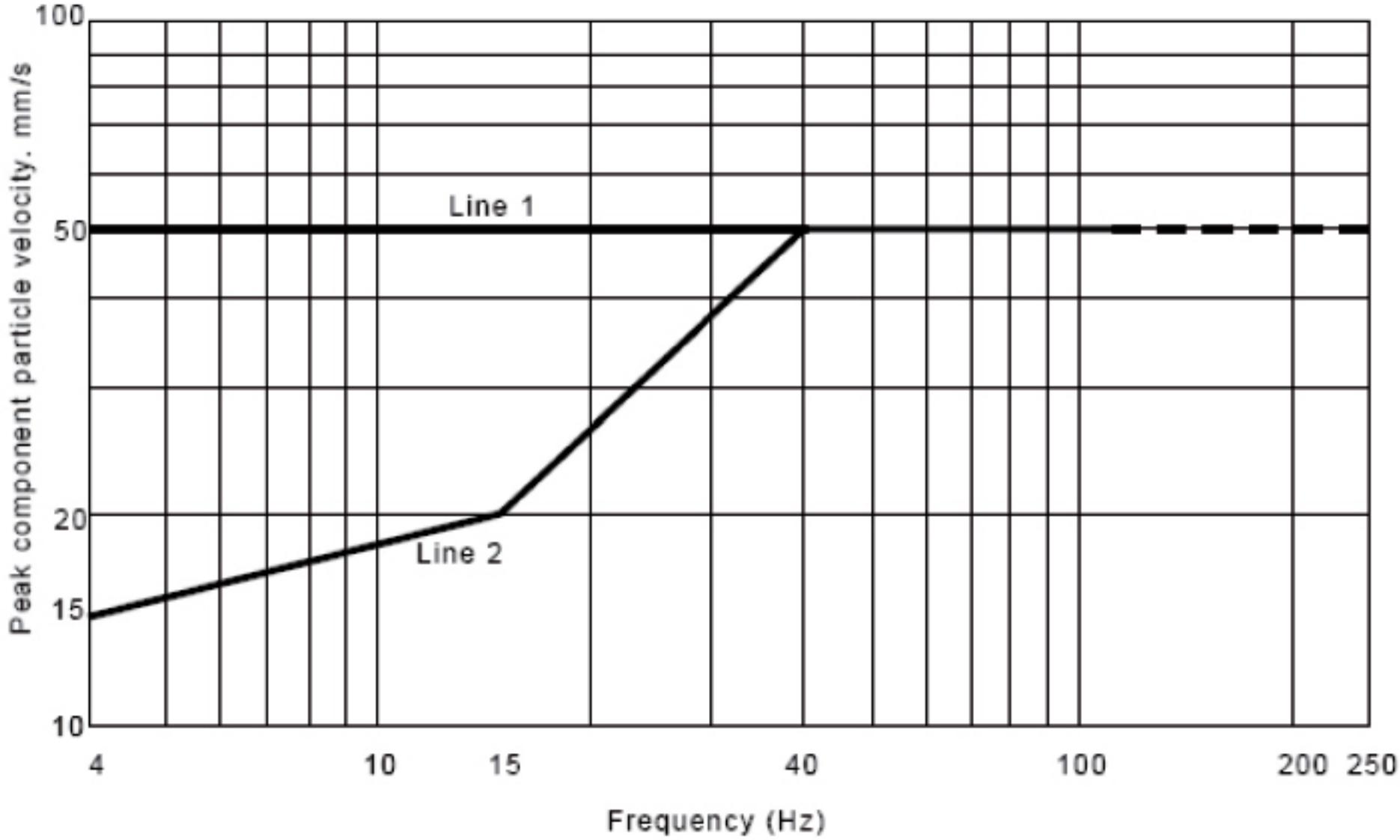
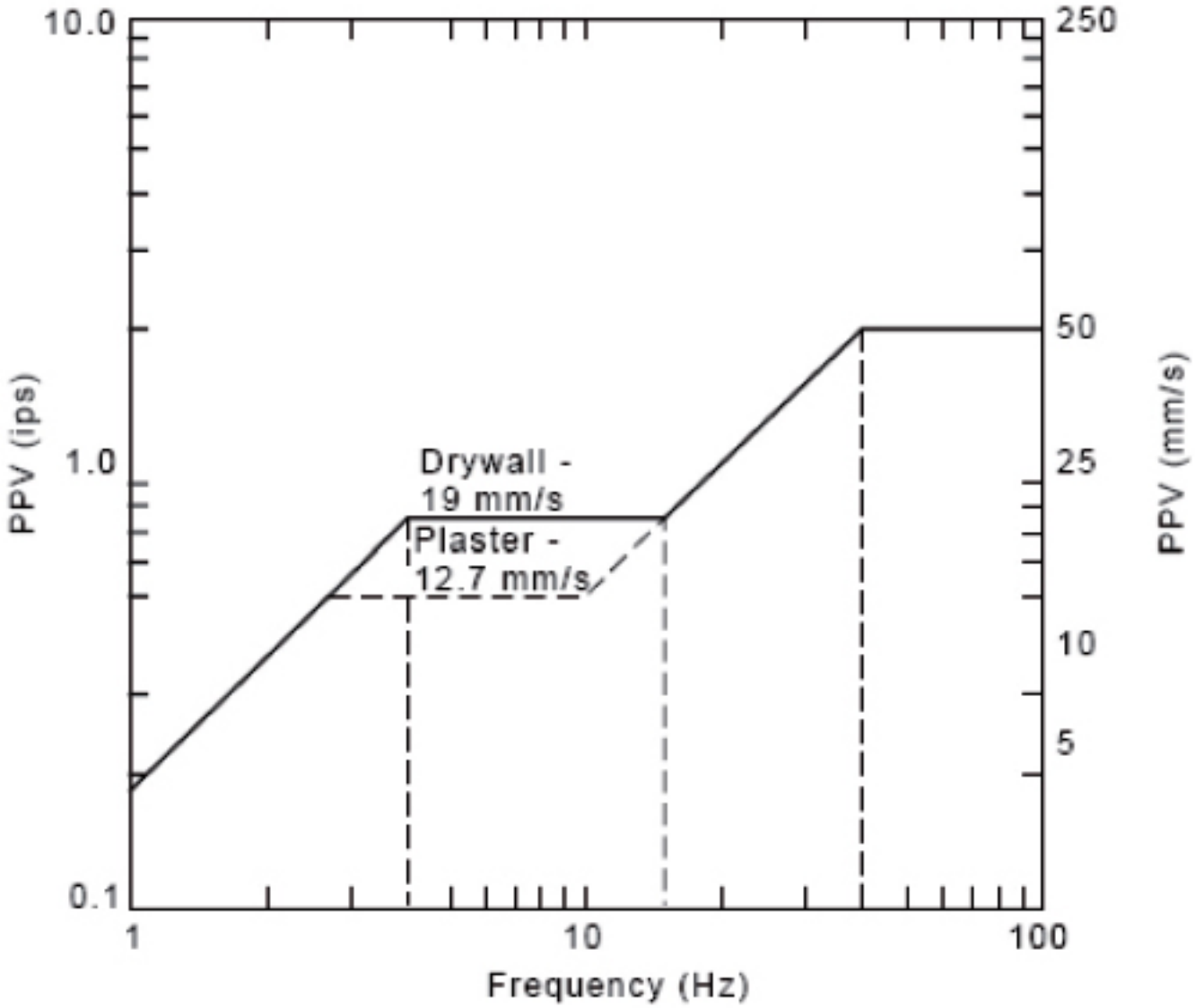


Table 1.3 BS 7385-1:1990-Damage Classification

Damage classification	Description
Cosmetic	The formation of hairline cracks on drywall surfaces or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in the mortar joints of brick/concrete block construction
Minor	The formation of cracks or loosening and falling of plaster or drywall surfaces, or cracks through bricks/concrete blocks
Major	Damage to structural elements of the building, cracks in support columns, loosening of joints, splaying of masonry cracks etc.

USBM Damage Classification

Uniform classification	Description
Threshold	Loosening of paint; small plaster crack at joints between construction elements; lengthening of old cracks
Minor	Loosening and falling of plaster; cracks in masonry around openings near partitions; hairline to 3 mm cracks (0 to 1/8 in); fall of loose mortar
Major	Cracks of several mm in walls; rupture of opening vaults; structural weakening; fall of masonry, e.g., chimneys; load support ability effected



USBM 'Safe' blasting vibration level criteria.

Table 1.4 Vibration standards for buildings, DIN 4150–3

Group	Type of structure	Peak vibration velocity, mm/s			
		At foundation at a frequency of			Plane of uppermost storey
		Less than 10 Hz	10 Hz to 50 Hz	to 100 Hz to 100 Hz	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	2 to 8	8 to 10	8

Source: DIN 4150–3:1999–02 Vibration in buildings—Part 3: effects on structures