

DIN 4150-1:2022-12 (E)

Vibrations in buildings - Part 1: Predictions of vibration parameters

Contents		Page
Foreword		5
1 Scope		6
2 Normative references		6
3 Terms and definitions		6
4 Prediction principles		7
4.1 Method		7
4.2 Propagation of vibration		7
4.3 Transmission to structures		11
4.3.1 General		11
4.3.2 Transmission of vertical vibration from the subsoil to the foundation		11
4.3.3 Transmission of vertical vibration from the foundation to floors		12
4.3.4 Transmission of horizontal vibration		13
5 Vibration sources		13
5.1 Excitation due to single events		13
5.1.1 General		13
5.1.2 Blasting		13
5.1.3 Falling masses		15
5.1.4 Induced seismic events		16
5.2 Excitation due to construction work		16
5.2.1 General		16
5.2.2 Impulsive vibration sources		16
5.2.3 Stationary vibration sources		16
5.2.4 Vibration induced during general construction work		17
5.3 Excitation due to traffic		18
5.3.1 General		18
5.3.2 Rail traffic		18
5.3.3 Road traffic		19
5.3.4 Shipping (inland waterway transport)		20
5.4 Excitation due to machinery		20
5.4.1 General		20
5.4.2 Machines with periodic excitation characteristics		20
5.4.3 Machines with transient excitation characteristics		21
5.4.4 Machines with periodic shock excitation		21
5.4.5 Machine groups		21
Annex A (informative) Source types with characteristic examples		22
A.1 General		22
A.2 Blasts (see 5.1.2)		22
A.2.1 General		22
A.2.2 Propagation in the free field		22
A.2.3 Transmission to building		24
A.3 Falling masses (see 5.1.3)		26
A.3.1 General		26
A.3.2 Chimney blasting		26
A.3.3 Blasting — Three chimneys		28
A.4 Impulsive vibration sources (see 5.2.2)		29

A.4.1	General.....	29
A.4.2	Pile driving of precast piles — Single drive and drive sequence	29
A.5	Stationary vibration sources (see 5.2.3).....	31
A.5.1	General.....	31
A.5.2	Vibratory compaction	32
A.5.3	Resonance caused by vibratory pile driving (see 5.2.3)	34
A.5.4	Vibro-compaction.....	35
A.6	Rail traffic (see 5.3.2)	36
A.6.1	General.....	36
A.6.2	Passing of a freight train	36
A.6.3	Passing of a regional train	38
A.6.4	Passing of subway train.....	39
A.7	Road traffic (see 5.3.3).....	40
A.7.1	General.....	40
A.7.2	Passing of an articulated bus.....	40
A.7.3	Passing of a lorry on a highway	42
A.8	Vibration induced by machinery.....	43
A.8.1	General.....	43
A.8.2	Screening trough with mono-frequency excitation on a building floor (see 5.4.2)	43
A.8.3	Vibration induced by CHP drive on a ground level foundation (see 5.4.2).....	44
A.8.4	Vibration-isolated hammer system (see 5.4.3)	45
A.8.5	Metal forming machinery (see 5.4.3)	46
A.8.6	Punching machine for cardboard boxes on floor slab (see 5.4.4)	48
A.8.7	Saw frame in operation (see 5.4.4).....	49
A.8.8	Saw frame idle (see 5.4.4).....	51
	Bibliography	52

Figures

Figure 1	— Vibration amplitude attenuation over distance due to spatial propagation.....	10
Figure 2	— Effect of vibration energy absorption by the soil on vibration amplitude attenuation with increasing distance, as a factor of frequency acc. to Equation (2); as an example for: $D_B = 0,01$ and $c_s = 200$ m/s.....	11
Figure A.1	— Blasts — Propagation of vibration: Variation over time and spectra	23
Figure A.2	— Blasts — Propagation of vibration: Amplitudes and best-fit lines for single components	24
Figure A.3	— Blasts — Vibration in a building: Variation over time and spectra	26
Figure A.4	— Falling masses — Chimney blasting in a port area: Variation over time and spectra	28
Figure A.5	— Influence of distance on the maximum vibration velocities in the mass impact of three similar chimneys made of reinforced concrete — Vibration velocity v_{max} acc. to individual components	29
Figure A.6	— Pile driving (single drive) — Vibration propagation: Variation over time and spectra.....	30
Figure A.7	— Pile driving (drive sequence) — Vibration propagation: Variation over time and spectra.....	31

Figure A.8 — Vibratory compaction — Propagation of vibration: Variation over time and spectra....	33
Figure A.9 — Vibratory compaction — Propagation of vibration: Amplitudes and best-fit line.....	33
Figure A.10 — Vibratory pile driving — Resonance in buildings: Variation over time and frequency spectra	34
Figure A.11 — Vibro-compaction — Resonance in buildings: Variation over time and frequency spectra.....	36
Figure A.12 — Variation over time and frequency spectra for a passing freight train	37
Figure A.13 — Regional train, above-ground.....	38
Figure A.14 — Regional train, underground.....	39
Figure A.15 — Passing of an articulated bus — Variation over time and spectra.....	41
Figure A.16 — Passing of a lorry on a highway — Variation over time and spectra	43
Figure A.17 — Screening trough with mono-frequency excitation on a floor slab — Variation over time and spectrum	44
Figure A.18 — CHP drive on ground level foundation — Variation over time and spectrum.....	45
Figure A.19 — Forging hammer — Variation over time and spectrum.....	46
Figure A.20 — Operation of several forging aggregates — Variation over time and spectrum	48
Figure A.21 — Punching machine for cardboard boxes on floor slab.....	49
Figure A.22 — Saw frame in operation — Variation over time and spectra.....	50
Figure A.23 — Idling saw frame — Variation over time and spectra.....	51