

INCE Classification of Subjects in Noise Control Engineering

Below is the classification system (version 7.0) used by the Institute of Noise Control Engineering of the USA (INCE/USA) and the International Institute of Noise Control Engineering (I-INCE). An explanation of this classification system appeared in *Noise/News International*, **2**, 12-24, March 1994.

GENERAL

01 International INCE

- 01.1 INCE/USA (US)
- 01.2 Acoustical Society of Denmark (DK)
- 01.3 Acoustical Society of Norway (NO)
- 01.4 Acoustical Society of Japan (JP)
- 01.5 Schweizerische Gesellschaft fuer Akustik (CH)
- 01.6 Acoustical Society of America (US)
- 01.7 Normenausschuss Akustik, Laermminderung & Schwingungstechnik (DE)
- 01.8 South African Acoustics Institute (ZA)
- 01.9 Australian Acoustical Society (AU)

02 International INCE (continued)

- 02.1 The Institute of Noise Control Engineering of Japan (JP)
- 02.2 Nederlands Akoestisch Genootshap (NL)
- 02.3 Committee on Acoustics of the Polish Academy of Sciences (PL)
- 02.4 Canadian Acoustical Association (CA)
- 02.5 Acoustical Commission of the Hungarian Academy of Sciences (HU)
- 02.6 Association Belge des Acousticiens (BE)
- 02.7 Acoustical Commission of the Romanian Academy of Sciences (RO)
- 02.8 Acoustical Society of Sweden (SE)
- 02.9 Institute of Acoustics, United Kingdom (GB)

03 International INCE (continued)

- 03.1 Acoustical Society of China (CN)
- 03.2 Acoustical Society of Finland (FI)
- 03.3 Acoustical Society of Korea (KR)
- 03.4 Associazione Italiana di Acustica (IT)
- 03.5 Osterreichischer Arbeitsring fuer Laermbekaempfung (AT)
- 03.6 Noise Section, Environmental Engineering Society Singapore (SG)
- 03.7 Groupe Acoustique Industrielle et Environnement (FR)
- 03.8 Sociedade Brasileira de Acustica (BR)
- 03.9 New Zealand Acoustical Society (NZ)

04 International INCE (continued)

- 04.1 Hungarian Society for Optics, Acoustics and Filmtechnics (HU)
- 04.2 East European Acoustical Association
- 04.3 Deutsche Gesellschaft fuer Akustik (DE)
- 04.4 Lithuanian Acoustical Society

05 Publications (other than technical articles)

- 05.1 Books
- 05.2 Book reviews

- 05.3 Editorials
- 05.4 Announcements and calendars
- 05.5 Biographical and personal notes
- 05.6 Bibliographies
- 05.7 Patents
- 05.8 Errata and addenda

06 History and philosophy

07 Education

08 Noise programs

08 Noise programs

- 08.1 National governments
- 08.2 State governments
- 08.3 Local governments
- 08.4 Universities
- 08.5 Industries
- 08.6 Trade associations

09 Definitions and descriptors

EMISSION: NOISE SOURCES (Noise generation and control)

10 General

11 Noise-generating devices (including components and subassemblies)

- 11.1 Mechanical devices (noise generated mechanically)
 - 11.1.1 Bearings*
 - 11.1.2 Cams*
 - 11.1.3 Gears*
 - 11.1.4 Belts and belt pulleys*
 - 11.1.5 Drive trains*
 - 11.1.6 Stepping mechanisms*
 - 11.1.7 Clutches*
 - 11.1.8 Actuators*
 - 11.1.9 Chains*
- 11.2 Electrical elements (noise generated electrically)
 - 11.2.1 Resistors, capacitors, inductors, diodes*
 - 11.2.2 Transformers*
 - 11.2.3 Ballasts*
 - 11.2.4 Solenoids*
 - 11.2.5 Switches*
 - 11.2.6 Circuit breakers*
- 11.3 Hydraulic/pneumatic elements
 - 11.3.1 Valves*
 - 11.3.2 Orifices and nozzles*
 - 11.3.3 Piping*
- 11.4 Air-moving and distribution devices
 - 11.4.1 Axial fans*

- 11.4.2 *Centrifugal blowers*
- 11.4.3 *Mixed-flow devices*
- 11.4.4 *Diffusers and grilles*
- 11.4.5 *Dampers*
- 11.5 *Electric power devices*
 - 11.5.1 *Electric motors*
 - 11.5.2 *Electric generators*
 - 11.5.3 *Power supplies*
- 11.6 *Other power devices*
 - 11.6.1 *Air motors*
 - 11.6.2 *Compressors (air, gas, vapor)*
 - 11.6.3 *Pumps (oil, water, other liquids)*
 - 11.6.4 *Engines*
 - 11.6.5 *Gas turbines*
 - 11.6.6 *Power transmissions*
- 11.7 *Rolling contact noise sources*
 - 11.7.1 *Tires and road-tire interactions*
 - 11.7.2 *Metal wheels and wheel-rail interactions*
 - 11.7.3 *Rollers*
- 11.8 *Stick-slip motional noise sources*
 - 11.8.1 *Brake squeal*
 - 11.8.2 *Clutch squeal*
 - 11.8.9 *Other friction squeal sources*
- 11.9 *Signaling devices*
 - 11.9.1 *Bells*
 - 11.9.2 *Horns*
 - 11.9.3 *Whistles*
 - 11.9.4 *Sirens*
 - 11.9.5 *Fog horns*
 - 11.9.6 *Impulsive devices*
 - 11.9.9 *Other warning devices*

12 Stationary noise sources

- 12.1 *Large equipment (indoor and outdoor; major source dimension greater than 1 meter)*
 - 12.1.1 *Electric power transformers*
 - 12.1.2 *Cooling towers and heat exchangers*
 - 12.1.3 *Chillers*
 - 12.1.4 *Motors and generators*
 - 12.1.5 *Primary power sources (diesel engines, gas turbines)*
 - 12.1.6 *Furnaces, burners, boilers and incinerators*
 - 12.1.7 *Stacks and flares*
 - 12.1.8 *Large rotating electrical equipment*
- 12.2 *Construction and demolition equipment (stationary)*
 - 12.2.1 *Pneumatic and hydraulic tools*
 - 12.2.2 *Air compressors*
 - 12.2.3 *Pile drivers*

- 12.2.4 *Concrete mixers*
- 12.2.5 *Space heaters*
- 12.2.6 *Wood chippers*
- 12.3 Computers and business equipment
 - 12.3.1 *Subassemblies*
 - 12.3.2 *Typewriters and word processing equipment*
 - 12.3.3 *Office and business equipment*
 - 12.3.4 *Computer equipment*
 - 12.3.5 *Commercial heating and ventilating equipment*
- 12.4 Home appliances and small equipment
 - 12.4.1 *Radio, television and high fidelity*
 - 12.4.2 *Room air conditioners, humidifiers and dehumidifiers*
 - 12.4.3 *Home heating and ventilating equipment*
 - 12.4.4 *Vacuum cleaners and powered cleaning equipment*
 - 12.4.5 *Small appliances and housewares*
 - 12.4.6 *Major appliances*
 - 12.4.7 *Personal equipment - electrically powered*
 - 12.4.8 *Plumbing equipment and fixtures*
 - 12.4.9 *Cameras and projectors*
- 12.5 Power tools
 - 12.5.1 *Portable power tools (gasoline, electric or air power)*
 - 12.5.2 *Stationary power tools*
- 12.6 Vibratory equipment
 - 12.6.1 *Feeders*
 - 12.6.2 *Shakers and shake-outs*
 - 12.6.3 *Conveyors*
 - 12.6.4 *Hopper vibrators*
 - 12.6.5 *Concrete vibrators*
- 12.7 Truck-mounted equipment
 - 12.7.1 *Solid waste compactors*
 - 12.7.2 *Refrigeration units*
 - 12.7.3 *Air compressors*
- 12.8 Equipment for transporting materials
- 12.9 Equipment for recreational areas and sports
 - 12.9.1 *Amusement park equipment*
 - 12.9.2 *Ski area equipment*
 - 12.9.3 *Equipment for sound amplification*
 - 12.9.4 *Auxiliary power units for RV's and motor homes*
 - 12.9.5 *Swimming pool filter pumps*

13 Moving noise sources

- 13.1 Aircraft
 - 13.1.1 *Subsonic aircraft (fixed wing)*
 - 13.1.2 *Supersonic aircraft*
 - 13.1.3 *CTOL, VTOL, and STOL aircraft*
 - 13.1.4 *Helicopters*
 - 13.1.5 *Sources of external aircraft noise*

- 13.1.6 Aircraft interior noise*
- 13.2 Highway vehicles
 - 13.2.1 Automobiles*
 - 13.2.2 Motorcycles*
 - 13.2.3 Buses*
 - 13.2.4 Trucks*
 - 13.2.5 Recreational vehicles*
 - 13.2.6 Snow plows and snow removal equipment*
- 13.3 Off-road vehicles
 - 13.3.1 Snowmobiles*
 - 13.3.2 All terrain vehicles*
 - 13.3.3 Motorcycles*
 - 13.3.4 Snow cats*
 - 13.3.5 Modified automobiles*
 - 13.3.6 Racing vehicles*
- 13.4 Railbound vehicles
 - 13.4.1 Railway trains (locomotives, coaches, freight cars)*
 - 13.4.2 Underground and elevated trains*
 - 13.4.3 Street rail vehicles (streetcars, trams, etc.)*
 - 13.4.4 Monorails*
- 13.5 Ships and marine vehicles
 - 13.5.1 Craft for inland waterways, including pleasure boats*
 - 13.5.2 Transoceanic vessels*
 - 13.5.3 Recreational water craft*
 - 13.5.4 Hovercraft, hydrofoils, and surface effect vehicles*
- 13.6 Small engine-powered equipment
 - 13.6.1 Lawn mowers*
 - 13.6.2 Agricultural and garden care equipment*
 - 13.6.3 Snow blowers*
 - 13.6.4 Leaf blowers*
 - 13.6.5 Shredders/grinders*
 - 13.6.6 Log splitters*
 - 13.6.7 Electric-powered equipment*
- 13.7 Large engine-powered mobile equipment (non-highway)
 - 13.7.1 Construction and earth-moving equipment*
 - 13.7.2 Materials handling equipment*
- 13.8 Sources inside moving vehicles, including ships and aircraft

14 Specialized industrial machinery and equipment

- 14.1 Machinery used in manufacturing industries
 - 14.1.1 Tobacco processing (SIC 21)*
 - 14.1.2 Textile mills (SIC 22)*
 - 14.1.3 Apparel and related products (SIC 23)*
 - 14.1.4 Lumber and wood products (SIC 24)*
 - 14.1.5 Furniture and fixtures (SIC 25)*
 - 14.1.6 Paper and allied products (SIC 26)*
 - 14.1.7 Printing and publishing (SIC 27)*

- 14.1.8 *Chemicals and allied products (SIC 28)*
- 14.1.9 *Petroleum and coal products (SIC 29)*
- 14.2 Machinery used in manufacturing industries (continued)
 - 14.2.1 *Leather and leather products (SIC 31)*
 - 14.2.2 *Stone, clay and glass products (SIC 32)*
 - 14.2.3 *Primary metals (SIC 33)*
 - 14.2.4 *Fabricated metal products (SIC 34)*
 - 14.2.5 *Machinery - except electric (SIC 35)*
 - 14.2.6 *Electrical machinery (SIC 36)*
 - 14.2.7 *Transportation equipment (SIC 37)*
 - 14.2.8 *Food products (SIC 20)*
 - 14.2.9 *Rubber and plastic products (SIC 30)*
- 14.3 Mining and quarrying equipment
 - 14.3.1 *Surface operations*
 - 14.3.2 *Underground operations*
- 14.4 Farming machinery
 - 14.4.1 *Threshing machines*
 - 14.4.2 *Harvesting equipment*
 - 14.4.3 *Milking equipment*
 - 14.4.4 *Conveyors, pneumatic transporters*
 - 14.4.5 *Dryers (hay, corn etc)*
 - 14.4.6 *Heaters*
 - 14.4.7 *Farm tractors*
- 14.5 Power generation and transmission (SIC 49)
 - 14.5.1 *Electrical transmission lines and equipment*
 - 14.5.2 *Natural gas transmission equipment*
 - 14.5.3 *Power station equipment*
 - 14.5.4 *Wind turbines and wind farms*
- 14.6 Automated assembly and manufacturing equipment
 - 14.6.1 *Welding robots*
 - 14.6.2 *Painting robots*

PHYSICAL PHENOMENA

21 Physical mechanisms of noise generation

- 21.1 Theoretical sound sources
 - 21.1.1 *Monopoles*
 - 21.1.2 *Dipoles*
 - 21.1.3 *Quadrupoles*
 - 21.1.4 *Other multipoles*
- 21.2 Noise produced by solid bodies
 - 21.2.1 *Vibrating bodies*
 - 21.2.2 *Contacting bodies - impulsive sounds*
 - 21.2.3 *Sliding bodies*
- 21.3 Rapid changes in temperature and/or pressure
 - 21.3.1 *Explosions*
 - 21.3.2 *Combustion*

- 21.3.3 *Cavitation*
- 21.3.4 *Blast waves*
- 21.3.5 *Transient or impulsive noise*
- 21.3.6 *Noise from weapons*
- 21.4 Resonance, standing waves and normal modes (also 25.1)
 - 21.4.1 *Vibrating air columns (one-dimensional)*
- 21.5 Interaction of a moving solid with a fluid
 - 21.5.1 *Movement of solid body through fluid*
- 21.6 Flow noise, aerodynamic sound
 - 21.6.1 *Produced by jets*
 - 21.6.2 *Blade slap and blade-vortex interactions*
 - 21.6.3 *Blade vortex interactions*
 - 21.6.4 *Produced by turbulence; ingestion and boundary layers*
 - 21.6.5 *Produced by fluid-boundary interactions*
 - 21.6.6 *Flow-induced noise generation in ducts and pipes*
 - 21.6.7 *Supersonic flow, shock waves, sonic booms*
 - 21.6.8 *Nonlinear effects*
 - 21.6.9 *Cavities*
- 21.7 Vibration excitation by mechanical and electrical sources
- 21.8 Non-audible sounds
 - 21.8.1 *Infrasonic sound*
 - 21.8.2 *Ultrasonic sound*

22 Natural sources of noise

- 22.1 Rain storms, including thunderstorms
- 22.2 Waterfalls and streams
- 22.3 Wind
- 22.4 Waves
- 22.5 Surf
- 22.6 Animate sources
 - 22.6.1 *Birds*
 - 22.6.2 *Insects*
 - 22.6.3 *Barking dogs*
- 22.7 Other

23 Propagation, transmission & scattering of sound (general wave equation)

- 23.1 Radiating surfaces
- 23.2 Reflection and echoes
- 23.3 Refraction and focusing
- 23.4 Diffraction
- 23.5 Interference
- 23.6 Scattering
- 23.7 Reverberation
- 23.8 Directivity
- 23.9 Transmission

24 Sound propagation in the atmosphere

- 24.1 Divergence decrease

- 24.2 Absorption (attenuation) of sound in air
- 24.3 Effects of fog and precipitation
- 24.4 Reflection by and diffraction around obstacles
- 24.5 Topographical factors; effects of grass, shrubs and trees
- 24.6 Meteorological factors; effects of wind, temperature and humidity
- 24.7 Scattering by small-scale temperature and wind variations
- 24.8 Reflection and absorption at small angles over a ground surface
- 24.9 Effects of ground impedance and height above ground level

25 Sound propagation in enclosed spaces

- 25.1 Standing waves and normal modes
- 25.2 Steady-state response
- 25.3 Diffusivity
- 25.4 Reverberation and echoes
- 25.5 Decrease with distance from the source

26 Sound Propagation in ducts

- 26.1 General theory of propagation in ducts
 - 26.1.1 *Without fluid flow*
 - 26.1.2 *With fluid flow*
 - 26.1.3 *With hard, non-absorbing surfaces*
 - 26.1.4 *With absorptive surfaces*
- 26.2 Radiation from duct terminations

NOISE CONTROL ELEMENTS (for path noise control)

30 General

31 Barriers and screens, shielding

- 31.1 Outdoors
- 31.2 Partial-height partitions indoors
 - 31.2.1 *Barriers in industrial halls*
 - 31.2.2 *Barriers in open-plan offices*

32 Enclosures for noise sources

- 32.1 Sound absorptive materials in enclosures
- 32.2 Wall construction
- 32.3 Isolation of plumbing and other wall penetrations
- 32.4 Ventilation openings
- 32.5 Doors and access openings
- 32.6 Windows

33 Sound isolating elements (including panels, partitions and curtains)

34 Filters, mufflers, silencers and resonators (conventional types)

- 34.1 Dissipative type
- 34.2 Reactive type
- 34.3 Helmholtz resonators

35 Absorptive materials

- 35.1 Mechanisms of absorption - theory
- 35.2 Physical properties

- 35.2.1 *Bulk sound absorption coefficient*
- 35.2.2 *Acoustic impedance*
- 35.2.3 *Flow resistance; effect of airflow rate*
- 35.2.4 *Density*
- 35.2.5 *Porosity*
- 35.2.6 *Elasticity of structures*
- 35.2.7 *Propagation constants*
- 35.2.8 *Structure factor*
- 35.2.9 *Non-acoustical properties*
- 35.3 Commercial acoustical materials
- 35.4 Common materials
 - 35.4.1 *General building materials*
 - 35.4.2 *Furnishings and chairs*
 - 35.4.3 *Audience and individual persons*
 - 35.4.4 *Floor coverings*
 - 35.4.5 *Sprayed mineral fibers*
- 35.5 Materials for special applications
 - 35.5.1 *Exposed to high temperatures (flame retardant)*
 - 35.5.2 *Exposed to high gas velocities*
 - 35.5.3 *Exposed to severe weather conditions*
 - 35.5.4 *Surface treatments for anechoic chambers*
 - 35.5.5 *Roadway materials*
- 35.6 Perforated facings for absorptive materials
- 35.7 Resonant absorbers
- 35.8 Wrappings and lagging materials

36 Hearing protective devices

- 36.1 Earmuffs
- 36.2 Ear plugs
- 36.3 Helmets
- 36.4 Active noise reduction in protective devices

37 Noise attenuation and transmission in ducts

- 37.1 Lined ducts
- 37.2 Unlined ducts
- 37.3 Plenums
- 37.4 Area changes, bends and elbows
- 37.5 Transmission through duct walls
- 37.6 Duct attenuators
- 37.7 Active noise control in ducts

38 Special treatments

- 38.1 Noise control by masking
- 38.2 Active noise control (three dimensions)
- 38.3 Active vibration control for noise reduction
- 38.4 Noise control by operational changes
 - 38.4.1 *Traffic control*
 - 38.4.2 *Routing and scheduling control*
- 38.5 Change of configuration or design for noise control purposes

- 38.5.1 *Smart structures*
- 38.5.2 *Material tailoring*
- 38.6 Seals for openings
 - 38.6.1 *Absorptive seals (absorptive linings around openings)*
 - 38.6.2 *Sealing cements, plastic & rubber mastics, foams, etc.*
 - 38.6.3 *Sealing tapes and caulking materials*
 - 38.6.4 *Foam and rubber ribbons and profiles*

VIBRATION AND SHOCK: GENERATION, TRANSMISSION, ISOLATION AND REDUCTION

40 General

41 Characteristics of sources of vibration and shock

- 41.1 Periodic vibration, sinusoidal
- 41.2 Stationary random vibration
- 41.3 Transients and shocks, impacts
- 41.4 Non-stationary random vibration
- 41.5 Nonlinear vibrations

42 Vibrating surfaces and structures (beams, plates, shells)

43 Propagation in structures (solid-borne noise)

- 43.1 Decrease due to spreading
- 43.2 Transmission and attenuation in solid structures
 - 43.2.1 *Mechanical constructions (internal damping)*
 - 43.2.2 *Buildings, civil engineering constructions*
 - 43.2.3 *Earth (geoacoustics)*
 - 43.2.4 *Foundations/soil interactions*
- 43.3 Reflections and interference
- 43.4 Vibration breaks
- 43.5 Structural intensity

44 Balancing of rotating and reciprocating machines

45 Reduction of impact forces; shock isolation and absorption

46 Vibration isolators and attenuators

- 46.1 Theories of vibration isolation and isolators
- 46.2 Vibration isolators
- 46.3 Foundation analysis and design
- 46.4 Active vibration control

47 Vibration-damping materials and structures

- 47.1 Mechanisms of damping - theory
- 47.2 Constrained layer damping
- 47.3 Damping of structures and panels
- 47.4 Dynamic absorbers

48 Vibration generators, shake tables

49 Effects of vibration and mechanical shock (on man, on structures)

- 49.1 On man

- 49.2 On structures and machines
 - 49.2.1 *Vibration induced effects*
 - 49.2.2 *Noise induced effects*
 - 49.2.3 *Designs to withstand high noise levels*
- 49.3 Criteria
 - 49.3.1 *Criteria for vibration of human body and organs*
 - 49.3.2 *Criteria for machine vibrations*
 - 49.3.3 *Criteria for shock in transportation of goods*
- 49.4 In buildings

IMMISSION: PHYSICAL ASPECTS OF ENVIRONMENTAL NOISE (Multiple sources and multiple paths)

50 General

51 Building noise control

- 51.1 Sound fields in rooms and enclosed spaces
 - 51.1.1 *Industrial halls and plants*
 - 51.1.2 *Concert or other halls for audiences or performances*
 - 51.1.3 *Special spaces (corridors etc).*
 - 51.1.4 *Classrooms*
 - 51.1.5 *Hospitals*
 - 51.1.6 *Churches*
- 51.2 Reduction of noise levels by increased absorption
- 51.3 Sound transmission thru windows, doors, walls, ceilings, floors
- 51.4 Sound-insulating structures, transmission coefficients and transmission loss
- 51.5 Flanking and impact transmission
- 51.6 Heating, ventilating and air conditioning (HVAC) systems
- 51.7 Landscaped (open plan) offices and lobbies
- 51.8 Elevators and escalators
- 51.9 Plumbing and piping noise

52 Community noise control

- 52.1 Community noise levels
- 52.2 Airport noise
 - 52.2.1 *Commercial airports*
 - 52.2.2 *Military airfields*
 - 52.2.3 *General aviation airports*
 - 52.2.4 *Heliports*
 - 52.2.5 *Police*
 - 52.2.6 *Hospitals*
 - 52.2.7 *Military*
- 52.3 Road traffic noise
- 52.4 Rail vehicle noise
- 52.5 Industrial noise (incl. noise around plants and power stations)
- 52.6 Construction noise

- 52.7 Sport and recreations areas and events
- 52.8 Residential area noise due to lawn mowers, air conditioners, etc
- 52.9 Planning for noise control, zoning, land use and urban planning

- 52.9.1 *Ambient sound levels*

53 In-plant noise control

- 53.1 In-plant noise levels
- 53.2 Exposures of workers
- 53.3 Planning, design and construction for noise control
- 53.4 Booths and control rooms

54 Shipboard and offshore platform noise control

- 54.1 Noise control in ship spaces
- 54.2 Noise control on offshore platforms
- 54.3 Underwater noise

55 Outdoor plant noise control design and construction

56 Noise surveys

- 56.1 Outdoors
- 56.2 Indoors
- 56.3 Soundscapes

IMMISSION: EFFECTS OF NOISE

60 General

61 Perception of sound

- 61.1 Biomechanics of the ear
- 61.2 Theories of hearing
- 61.3 Hearing levels and hearing thresholds of populations
- 61.4 Presbycusis and sociocusis
- 61.5 Critical bandwidths, masking
- 61.6 Just noticeable differences
- 61.7 Head-related transfer function

62 Physiological effects

- 62.1 Hearing loss (temporary and permanent threshold shifts)
- 62.2 Extra-auditory effects (fatigue, blood pressure, heart rate)
- 62.3 Hearing conservation programs
- 62.4 Workers compensation; liability for hearing loss
- 62.5 Effects of noise on health

63 Psychological effects

- 63.1 Loudness
- 63.2 Perceived noisiness, annoyance
- 63.3 Speech intelligibility and interference, speech levels, speech communication
- 63.4 Sleep disturbance
- 63.5 Work interference and efficiency
- 63.6 Infrasonic noise
- 63.7 Sound quality

64 Effects of noise on physical structures

- 64.1 On natural environment, parklands
- 64.2 On structures and in material, sonic fatigue
- 64.3 Sonic boom damage

65 Effects of noise on domesticated and wild animals

- 65.1 Domestic animals
- 65.2 Wildlife

66 Sociological effects: community reaction to noise

- 66.1 Community disturbance, interference with activities
- 66.2 Assessment of impact of community noise

67 Economic effects

- 67.1 Economic aspects of noise reduction
- 67.2 Cost-benefit analyses
- 67.3 Manufacturers', operators' and users' costs
- 67.4 Social costs of noise

68 Environmental impact statements

- 68.1 Background or ambient noise (baseline)
- 68.2 Environmental noise sources
- 68.3 Population exposure; impact criteria and assessment techniques
- 68.4 Highway projects
- 68.5 Airport projects
- 68.6 Public facilities under construction
- 68.7 Noise control planning; siting issues and zoning

69 Criteria and rating of noise

- 69.1 For acceptable levels of noise in rooms
- 69.2 For speech interference
- 69.3 For annoyance
- 69.4 For sonic-fatigue resistance
- 69.5 For land-use planning with respect to noise

ANALYSIS

70 General

71 Instruments for noise and vibration measurements

- 71.1 Transducers
 - 71.1.1 *Microphones, wind screens*
 - 71.1.2 *Vibration pick-ups*
 - 71.1.3 *Intensity probes*
 - 71.1.4 *Transducers for sound generation and reproduction*
 - 71.1.9 *Other sensors*
- 71.2 Amplifiers, including preamplifiers
 - 71.2.1 *Amplifiers for measurement systems*
- 71.3 Sound level meters
 - 71.3.1 Conventional
 - 71.3.2 Integrating-averaging
 - 71.3.3 Computer-based
- 71.4 Sound exposure meters

- 71.5 Waveform or frequency analyzers
- 71.6 Filters, analog and digital
- 71.7 Indicating devices
- 71.8 Data acquisition systems, recorders and data storage devices
- 71.9 Calibration; acoustical and electrical performance verification

72 Measurement techniques

- 72.1 Sound pressure level
- 72.2 Vibration level
 - 72.2.1 *Surface contact methods*
 - 72.2.2 *Non-contact methods (laser interferometry, holography)*
- 72.3 Sound intensity
- 72.4 Sound power
- 72.5 Transmission loss
- 72.6 Reverberation time
- 72.7 Measurement of properties of materials
 - 72.7.1 *Sound absorption*
 - 72.7.2 *Acoustic impedance*
 - 72.7.3 *Flow resistance; effect of airflow rate*
 - 72.7.4 *Density*
 - 72.7.5 *Porosity*
 - 72.7.6 *Elasticity of structures*
 - 72.7.7 *Propagation constants*
 - 72.7.8 *Structure factor*
 - 72.7.9 *Non-acoustical properties*
- 72.8 Impulsive noise measurements
- 72.9 Measurements of other quantities

73 Test facilities (design and qualification)

- 73.1 Free-field (anechoic rooms)
- 73.2 Free-field over a reflecting plane (hemi-anechoic rooms)
- 73.3 Reverberation rooms (diffuse field)
- 73.4 Outdoor test sites
- 73.5 Laboratory facilities (design and construction)
- 73.6 Other test environments (indoor and outdoors)
- 73.7 Scale models

74 Signal processing

- 74.1 Correlation and coherence analysis
- 74.2 Bursts and impulsive sounds
- 74.3 Digital processing and simulation
- 74.4 Automated data processing and reduction
- 74.5 Diagnosis and failure prediction
- 74.6 Source localization and transmission paths
- 74.7 Processing by microphone arrays
- 74.8 Frequency domain and spectral analysis
- 74.9 Other signal processing techniques

75 Methods of Mathematical Modeling

- 75.1 Statistical methods

- 75.2 Statistical energy analysis (SEA)
- 75.3 Finite element methods (FEM)
- 75.4 Computer algorithms including computer aided design
- 75.5 Boundary element methods (BEM)
- 75.6 Modal analysis
- 75.7 Imaging of acoustical and vibrational fields (holography, etc.)
- 75.8 Wave vector analysis
- 75.9 Analytical models

76 Modeling, prediction and simulation

- 76.1 Propagation models, noise models
 - 76.1.1 *Road traffic noise*
 - 76.1.2 *Rail traffic noise*
 - 76.1.3 *Noise in communities around airports*
 - 76.1.4 *External industrial noise*
 - 76.1.5 *Factory halls, sound level contours indoors*
 - 76.1.6 *Concert halls*
 - 76.1.7 *Sources of noise generation and emission*
- 76.2 Small scale modeling
- 76.3 Building foundation modeling
- 76.4 Computer software programs
- 76.9 Other modeling, prediction and simulation methods

77 Sampling, quality control procedures and measurement uncertainty

78 Audiometry, dosimetry and hearing measurements

79 Psychoacoustical evaluations and testing

- 79.1 Speech quality
- 79.2 Preference testing
- 79.2 Small scale modeling
- 79.3 Building foundation modeling
- 79.4 Computer software programs
- 79.9 Other modeling, prediction and simulation methods

REQUIREMENTS

80 General

81 Standards

- 81.1 National standards
- 81.2 International standards
 - 81.2.1 *International Organization for Standardization (ISO)*
 - 81.2.2 *International Electrotechnical Commission (IEC)*
 - 81.2.9 *Other international standards*
- 81.9 Other standards documents

82 National government legislation and regulations

83 State and local legislation and regulations

84 Other legislation and requirements

84.1 European Community requirements

85 Ordinances, including zoning requirements

86 Building codes

87 Specifications

88 Auditing, enforcement and certification

89 International noise policies and requirements