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(पहला पुनरीक्षण)

Acoustics in Buildings — Glossary of Terms

(First Revision)

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Functional Requirements in Buildings Sectional Committee, CED 12

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Functional Requirements in Buildings Sectional Committee had been approved by the Civil Engineering Division Council.

A series of National Standards have already been published to cover important functional aspects pertaining to the acoustical design and sound insulation of buildings. This standard was first published in 1981 with a view to bringing about uniformity in the expression of various terms applicable to acoustics in buildings.

Since then, the acoustic planning and design in India has come a long way and the revision of this standard has become necessary. This revision is brought out as the Committee responsible for this standard felt the need to cover the terminology in a comprehensive manner and add further definitions on the basis of experience gained over the years and also to bring it in line with the National Building Code of India 2016 (SP 7 : 2016). In this revision, besides the modification of the existing definitions, number of new terms have also been included. In the formulation of this standard due weightage has been given to international co-ordination among standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

ACOUSTICS IN BUILDINGS — GLOSSARY OF TERMS

(First Revision)

1 SCOPE

This standard covers brief description/definition of terms related to building acoustics. This standard aims to define terms which may be used by researchers, academicians, regulators and other enthusiasts working in the field of acoustics and noise insulation.

2 TERMINOLOGY

2.1 Absorption Coefficient — Ratio of sound energy absorbed to the incident sound energy on a material.

2.2 Absorption Unit — This is expressed in sabins (*see* 2.83).

2.3 Absorption of Surface — Product of the area of a surface and its absorption coefficient.

2.4 Acoustic — When used as a qualifying term, it means containing, producing, arising from, actuated by, or carrying sound, or designed to carry sound and capable of doing so, for example acoustic horn, transducer, energy, wave impedance.

2.5 Acoustical — When used as a qualifying term, it means related to, pertaining to, or associated with sound, but not having its properties or characteristics, for example acoustical engineer, terminology, unit.

2.6 Acoustical Treatment — Any treatment of surfaces of an enclosure or introduction therein of sound absorbing devices with the specific purpose of controlling the reverberation time of an enclosure.

2.7 Acoustics — It is the science of sound including its production, transmission and effects.

2.8 Air-borne Noise — Noise transmitted into an enclosure by air vibration through doors, windows, ventilating ducts and other openings.

2.9 Ambient Noise — The sound pressure levels associated with a given environment. Ambient noise is usually a composite of sounds from near and far sources, none of which are particularly dominant.

2.10 Articulation

a) A measure of the intelligibility of speech; and

b) The articulation of a system used for transmitting or reproducing speech in the percentage number or fraction of components correctly recognized over the system.

2.11 Attenuation — The decrease of sound power in decibels between two points in an acoustical system.

2.12 Audible Frequency Range — The range of sound frequencies normally heard by the human ear. The audible range spans from 20 Hz to 20 000 Hz.

2.13 A-weighted Sound Pressure, p_A — Value of overall sound pressure, measured in Pascal (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network.

NOTE — The A-weighting network modifies the electrical response of a sound level meter with frequency in approximately the same way as the sensitivity of the human hearing system.

2.14 A-weighted Sound Pressure Level, L_{pA} — The quantity of A-weighted sound pressure, in decibels (dB), as given by the following formula:

$$L_{pA} = 10 \log_{10} \left(\frac{p_A}{p_0} \right)^2$$

where

p_A = A-weighted sound pressure, in pascal (Pa); and

p_0 = reference sound pressure (20 μ Pa).

NOTE — Measurements of A-weighted sound pressure level can be made with a meter and correlate roughly with subjective assessments of loudness and are usually made to assist in judging the effects of noise on people. An increase or decrease in level of 10 dBA corresponds roughly to a doubling or halving of loudness.

2.15 Background Noise — The sound pressure levels in a given environment from all sources excluding a specific sound source being investigated or measured.

2.16 Baffle — A reflecting/absorbing structure, such as a partition, used to modify or restrict the distribution of sound in an acoustical system.

2.17 Bel — It is the fundamental division of a logarithmic scale used to express the ratio of two specified or implied quantities. the number of bels denoting such a ratio being the logarithm to the base.

2.17.1 *Decibel* (dB) — It is one-tenth of a bel.

Example:

$$\text{Sound power level} = 10 \log_{10} \frac{W}{W_0} \text{ in decibels, db}$$

$$\text{Sound power level} = 20 \log_{10} \frac{P}{P_0} \text{ in decibels, db}$$

where

W = measured acoustical power;

W_0 = reference acoustical power, expressed in the same units as *W;*

P = measured sound pressure; and

P_0 = reference sound pressure, expressed in the same units as *P*.

2.18 Break-in — Unwanted sound transmission into a duct or a quiet environment, from outside.

2.19 Break-out — Unwanted sound transmission from the inside of a duct or a noisy enclosure, to the outside.

2.20 Broad Band Noise — Spectrum consisting of a large number of frequency components, none of which is individually dominant.

2.21 Cavity Wall — A wall constructed of two separated thicknesses with a 50 mm to 100 mm (or more) cavity between, and held together by solid or flexible ties.

2.22 Completely Diffuse Sound — Sound which throughout any given region, has uniform energy density, and for which the directions of propagation at any point are wholly random in distribution.

2.23 Continuous and Impulsive Noise — Sound may be continuous, when the source is constantly vibrating, or as with many industrial noises, it may be impulsive in character, the source being set in vibration only for a short time. For instance, sound from a drop forge hammer belongs to the latter category. Here the high intensity pressure waves die away fast, although the peak levels attained are very high.

2.24 Cross-talk — Unwanted sound transmission between one room and another room or space, namely, a duct.

2.25 Curtain Wall — A non-structural wall.

2.26 Damage-Risk Noise Criteria — Damage-risk criteria specify the maximum levels and duration of noise exposure that can be considered safe.

2.27 Damping — Gradual, steady absorption of sound/vibration energy and consequent steady decrease of volume of sound.

2.28 Dead Spaces — Sets or studios are called ‘dead’ when these are enclosed by materials which absorb almost all sound within the set or studio.

2.29 Dead Spots — Locations in hall or room where the intensity of sound is negligible due to destructive interference of sound waves.

2.30 Diffracted Wave — A diffracted wave is one whose front has been changed in direction by an obstacle or another non-homogeneity in a medium, otherwise than by reflection or refraction.

2.31 Diffraction — Diffraction is that process which produces a 'diffracted wave.

2.32 Echo — A distinct and clearly discernible reflected sound received at a point within the enclosure when any sound emanates from any part of that enclosure. A quick succession of such echoes is called flutter or flutter echo.

2.33 Effective Perceived Noise Level, in Decibel (EPN dB) — The number for rating the noise of an individual aircraft flying overhead is the effective perceived noise level in decibels (EPN dB). The effective perceived noise decibel value takes into account the subjectively annoying effects of the noise including pure tones and duration. In principle, it is a kind of time-integrated loudness level.

2.34 Effective Sound Pressure (Root-Mean-Square Sound Pressure) — The effective sound pressure at a point is the root-mean-square value of the instantaneous sound pressure, over a time interval at a point under consideration. The term ‘effective sound pressure’ is frequently shortened to ‘sound pressure’.

2.35 Equivalent Continuous A-Weighted Sound Pressure Level, $L_{Aeq.T}$ — Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound, that within a specified time interval, *T*, has the same mean squared sound pressure as the sound under consideration that varies with time, and is given by the formula:

$$L_{Aeq.T} = 10 \log_{10} \left(\frac{1}{T} \int_0^T \frac{p_A^2(t)}{p_0^2} dt \right)$$

where

$p_A(t)$ = instantaneous A-weighted sound pressure, in Pascals (Pa); and

p_0 = reference sound pressure (20 μ Pa).

NOTE — Equivalent continuous A-weighted sound pressure level is mainly used for the assessment of environmental noise and occupational noise exposure.

2.36 Equivalent Sound Absorption Area of a Room, *A* — Hypothetical area of a totally absorbing surface without diffraction effects, expressed in square metres (m^2) which, if it were the only absorbing element in the room, would give the same reverberation time as the room under consideration.

2.37 Façade Level — Sound pressure level measured 1 m to 2 m in front of the façade.

2.38 Flutter Echo — A rapid multiple echo of even rate.

2.39 Forced Vibration — A vibration directly maintained in a system by a periodic force and having the frequency of the force.

2.40 Free Field — A free sound field is the field in a homogeneous, isotropic medium free from boundaries. In practice it is a field in which the effects of the boundaries are negligible over the region of interest.

2.41 Free-Field Level — Sound pressure level measured outside, far away from reflecting surfaces.

NOTE — Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as being free-field measurements. To minimise the effect of reflections the measuring position should be at least 3.5 m to the side of the reflecting surface (that is, not 3.5 m from the reflecting surface in the direction of the source). Estimates of noise from aircraft overhead usually include a correction of 2 dB to allow for reflections from the ground.

2.42 Free Vibration — A vibration resulting from a disturbance of a system and having a period depending solely on the properties of the system.

2.43 Frequency — Frequency is the number of vibrations per second. Frequency is generally expressed in cycles per second (cps) and is also denoted as Hertz (Hz).

2.44 Fundamental — Lowest natural frequency of oscillation for a vibration body.

2.45 Hearing Loss — The hearing loss of an ear at a specified frequency or for a specified type of sound is the difference between the sound pressure level corresponding to the threshold of hearing for that ear and the sound pressure level corresponding to the normal level of hearing.

2.46 Impact Noise — Noise generated in solid structures which gets transmitted as air-borne noise.

2.47 Impact Sound Pressure Level, L_i — Average sound pressure level in a specific frequency band in a room below a floor, when it is excited by a standard tapping machine.

2.48 Indoor Ambient Noise — Pervasive noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants.

2.49 Indoor Noise

a) Noises contributed by internal sources of noise, for example conversation of the occupants, footsteps, banging of doors, playing of radios, etc; and

b) Noises in industrial buildings are mainly of indoor origin. These are caused by the machinery in operation and the work processes involved.

2.50 Insertion Loss (L_{IL}) — Insertion loss is generally defined as the difference, in decibels, between two sound pressure levels (or power levels or intensity levels) which are measured at the same point in space before and after a muffler or any other noise control device is inserted between the measurement point and the noise source.

2.51 Intensity — Intensity at a point is the average rate at which sound energy is transmitted through a unit or around the point and perpendicular to the direction of propagation of sound.

2.52 Live Stage

a) A stage with a small amount of boundary absorption; and

b) A stage in use for a performance.

2.53 Loudness — It is the sensation produced in the human ear and it depends on the intensity of sound and its frequency.

2.54 Muffled Sound — Sound confused by overlap of syllables.

2.55 Multiple Echo — A succession of separate echoes from a single sound.

2.56 Noise — It is defined as unwanted sound which may be hazardous to health, interferes with communications or is disturbing.

2.57 Noise Criteria — Numerical indices used to define design goals for the maximum allowable noise in a given space.

2.58 Noise Exposure Forecast (NEF) — The noise exposure forecast at any location is the summation of the noise levels in EPN dB from all aircraft types, on all runways, suitably weighted for the number of operations during day time and night time.

2.59 Noise Rating (NR) — Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves.

2.60 Noise Reduction Coefficient (NRC) — A single figure descriptor of the sound absorption property of a material. It is the arithmetic mean of the sound absorption coefficients at 250 Hz, 500 Hz, 1 000 Hz and 2 000 Hz rounded off to the nearest multiple of 0.05.

2.61 Normalized Impact Sound Pressure Level, L_n — Impact sound pressure level normalized for a standard absorption area in the receiving room.

NOTE — Normalized impact sound pressure level is usually used to characterize the insulation of a floor in a laboratory against impact sound in a stated frequency band.

2.62 Octave Band — Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit.

2.63 Octave-Band Noise Levels — Noise is usually measured in groups of frequencies. A convenient grouping is f_0 to $2f_0$, $2f_0$ to $4f_0$, $4f_0$ to $8f_0$, etc. These are called octave bands.

2.64 Party Wall — Common wall separating two adjoining properties.

2.65 Peak Level — It is the maximum instantaneous level that occurs during a specified time interval. In acoustics, peak sound pressure level is to be understood, unless some other kind of level is specified.

2.66 Peak Sound Pressure — The peak sound pressure for any specified time interval is the maximum absolute value of the instantaneous sound pressure in that interval.

2.67 Peak to Peak Amplitude (Double Amplitude) — The peak-to-peak amplitude of an oscillating quantity is the algebraic difference between the extremes of the quantity.

2.68 Percentile Level, $L_{AN,T}$ — A-weighted sound pressure level obtained using time-weighting '*F*', which is exceeded for *N* percent of a specified time interval.

Example:

$L_{A90,1h}$ is the A-weighted level exceeded for 90 percent of 1 h.

NOTE — Percentile levels, determined over a certain time interval cannot accurately be extrapolated to other time intervals. Time-weighting '*F*' or '*S*' can be selected on most modern measuring instruments and used to determine the speed at which the instrument responds to changes in the amplitude of the signal. Time-weighting '*F*' is faster than '*S*' and so its use can lead to higher values when rapidly changing signals are measured.

2.69 Period — The time required for one complete cycle of a periodic quantity in seconds.

2.70 Pink Noise — Sound with an uninterrupted frequency spectrum and a power which is steady within frequency band and proportional to centre frequency. An example is constant power level per octave band.

2.71 Pitch — It is the frequency sensation as perceived by a human ear. It is defined as that aspect of auditory sensation in terms of which sounds may be arranged on a scale extending from low to high like a musical scale.

2.72 Power Spectrum Level — The power spectrum level of a sound at a specified frequency is the power level for the acoustic power contained in a band 1 Hz wide, centred at the specified frequency.

2.73 Public Address System (PA System) — The complete chain of sound equipment (comprising essentially microphones, amplifiers and loudspeakers) required to reinforce the sound emanating from a source in order to provide adequate loudness for comfortable hearing by the audience.

2.74 Pure Tone — A sound emitted at a single frequency.

2.75 Random Noise — It is a fluctuating quantity (such as sound pressure) whose instantaneous amplitudes occur, as a function of time, according to a normal (Gaussian) distribution.

2.76 Rating Level, L_{Ar}, T_r — Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise.

NOTE — This definition is used for rating industrial noise, where the noise is the specific noise from the source under investigation.

2.77 Resonance Air — Air within any enclosure is set into vibration by sound waves. All enclosures have their own resonance frequency which depends on the stiffness of entrapped air.

2.78 Resonance Frequency — A frequency at which resonance occurs in a system.

2.79 Resonance Structural — A resonant effect is produced by the coincidence of the period of the exerting external vibration with the natural period of oscillation of the body (building, structure).

2.80 Reverberation — Persistence of sound in an enclosure (partially or completely enclosed) after the source of sound has stopped.

2.81 Reverberation Chamber — A highly reverberant room with highly sound reflective surfaces, used for providing excess reverberation required for producing sound effects. Such rooms are also used for certain acoustical measurements.

2.82 Reverberation Time *T* — Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped.

NOTE — Reverberation time is usually measured in octave or third octave bands. It is not necessary to measure the decay over the full 60 dB range. The decay measured over the range 5 dB to 35 dB below the initial level is denoted by T_{30}, and over the range 5 dB to 25 dB below the initial level by T_{20}.

2.83 Sabin — The sound absorption due to unit area of a totally absorbent surface. This is equal to sound absorption of one square meter of 'open window'.

2.84 Simple Harmonic Motion — It is one in which the relationship between time t and displacement x can be expressed in the form x = A sin (wt + ϕ), where A is the amplitude, w the angular frequency, and ϕ the phase angle.

2.85 Sound — A vibrational disturbance, exciting hearing mechanisms, transmitted in a predictable manner determined by the medium through which it propagates. To be audible the disturbance shall have to fall within the frequency range of 20 Hz to 20 000 Hz.

2.86 Sound Exposure Level, L_{AE} — Level of a sound, of 1 s duration, that has the same sound energy as the actual noise event considered.

NOTES

1 The L_{AE} of a discrete noise event is given by the formula:

$$L_{AE} = 10 \log_{10}\left(\frac{1}{t_0}\int_{t_1}^{t_2}\frac{p_A^2(t)}{p_0^2}dt\right)$$

where

$t_2 - t_1$ = stated time interval in seconds (s) long enough to encompass all significant sound energy of the event;

$P_A(t)$ = instantaneous A-weighted sound pressure in Pascals (Pa);

t_0 = reference time interval (1 s); and

p_0 = reference sound pressure level (20 μ Pa).

2 L_{AE} is also known as L_{AX} (single-event noise exposure level).

2.87 Sound Insulation of Building Components — The reduction in the level of sound when it passes through a building component like wall, floor, roof, door, window, etc.

2.88 Sound Level Difference, *D* — Difference between the sound pressure level in the source room and the sound pressure level in the receiving room.

NOTE — *D* is given by the following formula.

$$D = L_1 - L_2$$

where

L_1 = average sound pressure level in the source room; and

L_2 = average sound pressure level in the receiving room.

2.89 Sound Level Meter — A device used to measure the sound pressure level or frequency weighted sound pressure level, constructed in accordance with international specifications.

2.90 Sound Power — The acoustic power of a sound source, expressed in watts.

2.91 Sound Power Level (L_w) — The acoustic power radiated from a given sound source as related to a reference power level (typically 10^{-12} watts) and expressed in decibels as:

$$L_p = 10 \log_{10}\left(\frac{W}{10^{-12}}\right)$$

or

$$L_w = 10 \log W + 120$$

where

W = acoustic power, in watts.

By definition, 1 W therefore, corresponds to 120 dB for L_w.

2.92 Sound Pressure, *p* — Root-mean-square value of the variation in air pressure measured in Pascals (Pa), above and below atmospheric pressure, caused by the sound.

2.93 Sound Pressure Level, L_p — Quantity of sound pressure, in decibels (dB), given by the formula:

$$L_p = 10 \log_{10} \left(\frac{p}{p_0}\right)^2$$

where

p = root mean square sound pressure in Pascals (Pa); and

p_0 = reference sound pressure (20 μ Pa).

NOTE — The range of sound pressures for ordinary sounds is very wide. The use of decibels gives a smaller, more convenient range of numbers. For example, sound pressure levels ranging from 40 dB to 94 dB correspond to sound pressures ranging from 0.002 Pa to 1 Pa. A doubling of sound energy corresponds to an increase in level of 3 dB.

2.94 Sound Receiver — One or more observation points at which sound is evaluated or measured. The effect of sound on an individual receiver is usually evaluated by measurements near the ear or close to the body.

2.95 Sound Reduction between Rooms — The sound reduction, in decibels, between two rooms is the amount by which the mean square sound pressure level in the source room exceeds the level in the receiving room. If a common partition separates two rooms, the first of which contains a sound source, the sound reduction between the two rooms is equal to the transmission loss of the partition plus a function of the total absorption in the second room and the area of the common partition.

2.96 Sound Reduction Index, R — Laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

2.97 Sound Source — Equipment or phenomena which generate sound. Source room is the room containing sound source.

2.98 Sound Transmission Class — STC is a single number rating of sound insulation for building assemblies such as doors, windows, and partitions. STC is derived from the sound transmission loss measured over frequencies ranging from 125 Hz to 4 000 Hz.

2.99 Sound Transmission Coefficient — Transmission loss denotes the reduction in magnitude (in decibels) of airborne sound between the source and receiver side of a material at a specific frequency band.

2.100 Spectrum — A quantity expressed as a function of frequency, such as sound pressure versus frequency curve.

2.101 Splay — Sloping or slanting surface.

2.102 Standardized Impact Sound Pressure Level, L'_{nT} — Impact sound pressure level normalized to that in a receiving room having a reverberation time of 0.5 s.

NOTE — Standardized impact sound pressure level is used to characterize the insulation of floors in buildings against impact sound in a stated frequency band.

2.103 Speech Interference Level (SIL) — A descriptor for rating steady noise according to its ability to interfere with conversation between two people. SIL is the arithmetic average of the sound pressure levels in the three octave bands with centre frequencies at 500 Hz, 1 000 Hz and 2 000 Hz.

2.104 Standardized Level Difference, D_{nT} — Difference in sound level between a pair of rooms, in a stated frequency band, normalized to a reverberation time of 0.5 s.

NOTE — Standardized level difference takes account of all sound transmission paths between the rooms.

2.105 Structure-Borne Noise and Ground-Borne

NOTE — When elements of a structure vibrate, they radiate noise and, if the vibration is high enough, this noise can be audible. Ground-borne and structure-borne noises are rarely an issue outside buildings or structures.

2.105.1 *Ground-Borne Noise* — Audible noise caused by the vibration of elements of a structure, for which the vibration propagation path from the source is partially or wholly through the ground.

NOTE — Common sources of ground-borne noise include railways and heavy construction work on adjacent construction sites.

2.105.2 *Structure-Borne Noise* — Audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements.

NOTE — Common sources of structure-borne noise include building services plant, manufacturing machinery and construction or demolition of the structure.

2.106 Third Octave Band — Band of frequencies in which the upper limit of the band is $2\frac{1}{3}$ times the frequency of the lower limit.

2.107 Threshold of Hearing — The lowest continuous sound pressure level which will create an auditory sensation for the average human ear. Any sound below these levels will be inaudible and any sound above the threshold will vary in loudness dependent on intensity.

2.108 Transient Sound — Sound which is audible for a limited period of time, for example, sound from over flight of an airplane.

2.109 Transmission Loss — The transmission loss between two points of a transmission system is the decrease in power, expressed in decibels.

2.110 Vibration Isolation — Reduction of force or displacement transmitted by a vibratory source, often attained by use of a resilient mount.

2.111 Wave Length — Wave length of a sinusoidal progressive wave in an isotropic medium. The perpendicular distance between two wave fronts in which the phases differ by one complete period.

2.112 Weighted Level Difference, D_w — Single-number quantity that characterizes airborne sound insulation between rooms but which is not adjusted to reference conditions.

NOTE — Weighted level difference is used to characterize the insulation between rooms in a building as they are; values cannot normally be compared with measurements made under other conditions.

2.113 Weighted Sound Reduction Index, R_w — Single number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies.

NOTE — The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory.

2.114 Weighted Standardized Impact Sound Pressure Level, $L'_{nT,w}$ — Single number quantity used to characterize the Impact sound insulation of floors over a range of frequencies.

NOTE — Weighted standardized impact sound pressure level is used to characterize the insulation of floors in buildings.

2.115 Weighted Standardized Level Difference, $D_{nT,w}$ — Single-number quantity, which characterizes the airborne sound insulation between rooms.

NOTE — Weighted standardized level difference is used to characterize the insulation between rooms in a building.

2.116 Weighted Normalized Impact Sound Pressure Level, $L'_{n,w}$ — Single number quantity used to characterize the impact sound insulation of floors over a range of frequencies.

NOTE — Weighted normalized impact sound pressure level is usually used to characterize the insulation of floors tested in a laboratory.

2.117 White Noise — A noise whose spectrum (level) density is substantially independent of frequency over a specified range and has equal power for any range of frequencies of constant band width.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Functional Requirements in Buildings Sectional Committee, CED 12

Organization	*Representative(s)*
CSIR - Central Building Research Institute, Roorkee	PROF R. PRADEEP KUMAR **(*Chairperson*)**
Adlakha Associates Pvt Ltd, New Delhi	SHRI PRAMOD ADLAKHA MS ABHAYA ADLAKHA (*Alternate*)
All India Glass Manufacturers' Federation, New Delhi	REPRESENTATIVE
Arena Consultants, Thane	AR ARCHANA SALIL
Building Materials and Technology Promotion Council, New Delhi	DR SHAILESH KR. AGRAWAL SHRI S. K. GUPTA (*Alternate*)
Bureau of Energy Efficiency, New Delhi	REPRESENTATIVE
Central Pollution Control Board, New Delhi	SHRI SHARANDEEP SINGH
Central Public Works Department, New Delhi	SHRI A. K. SHARMA SHRI SAJU SIDDHARTHAN (*Alternate*)
Centre for Accessibility in Built Environment Foundation, New Delhi	SHRI SUBHASH CHANDRA VASHISHTH
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Indian Buildings Congress, New Delhi	SHRI VISHV RATAN BANSAL SHRI MAMAN CHAND BANSAL (*Alternate*)
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Organization	*Representative(s)*
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Samarthyam, New Delhi	MS ANJLEE AGARWAL MS NIDHI MADAN (*Alternate*)
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Vastukala Academy, College of Architecture, New Delhi	PROF SANJAY MEHRA
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In Personal Capacity (*B-30, Sector - 57, Noida - 201301*)	SHRI GAUTAM SURI
BIS Directorate General	SHRI DWAIPAYAN BHADRA, SCIENTIST 'E'/DIRECTOR AND HEAD (CIVIL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRI DHEERAJ DAMACHYA
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