JECRC Foundation

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTER

Class – 3rd Year - V Semester: B.Tech. (Civil Engineering)
Subject –AIR & NOISE POLLUTION AND CONTROL
Ch –Noise pollution
Presented by – Assistant Professor Narendra Sipani

VISSION AND MISSION OF INSTITUE

Vision-

To become a renowned centre of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

Mission-

M1. Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.
M2. Identify, based on informed perception of Indian, regional and global needs, areas of focus and provide platform to gain knowledge and solutions.
M3. Offer opportunities for interaction between academia and industry.
M4. Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

VISSION AND MISSION OF DEPARTMENT

Vision-

To become a role model in the field of Civil Engineering for the sustainable development of the society.

Mission-

M1. To provide outcome base education.

M2. To create a learning environment conducive for achieving academic excellence.

M3. To prepare civil engineers for the society with high ethical values.

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1. Basic acoustical parameters
2. Outdoor and Indoor Noise Propagation
3. Psychoacoustics
4. Applied psychoacoustics
5. Psychoacoustics Model

BASIC ACOUSTICAL PARAMETERS

- Sound pressure
- sound pressure level
- Sound Power
- Sound Power level and
- sound intensity

SOUND PRESSURE

Sound Pressure is the force of sound on a surface area perpendicular to the direction of sound.

- Sound pressure is the difference between instantaneous absolute pressure and theambient pressure
- In air, sound pressure can be measured using a microphone, and in water with a hydrophone. We can define the mean-square sound pressure as

$$p_{rms}^2 = \frac{1}{T}\int_0^T p^2\,dt$$

where

prms is the root mean square of acoustic pressures

T is the period of measurement

p is the instantaneous acoustic pressures

The SI unit of sound pressure is the pascal (Pa).

SOUND PRESSURE LEVEL

Sound pressure level is the end result.

- Pressure level as a ratio of sound pressure to a base level.
- Sound Pressure Level (SPL) is a logarithmic measure of the RMS sound pressure of a sound relative to a reference value, the threshold of hearing. It is measured in decibels (dB).

Sound Pressure Level Formula

$$SPL\,(dB) = 10\,log_{10}\left(\frac{p^2}{{p_o}^2}\right)$$

$SPL\,(dB) - sound\ pressure\ level\ in\ dB$
$p - sound\ pressure\ in\ Pa$
$unit\ area\ in\ meters$
$p_o - reference\ sound\ pressure\ level\ in\ Pa$

for air ... water, steel, etc., are different.

SOUND POWER

Sound power is the rate at which sound energy is emitted, reflected, transmitted or received, per unit time.

- Sound Power Level and the Sound Power from some common sources as fans, jet engines, cars, humans and more ..
- The SI unit of sound power is the watt (W)
- Sound power passing through an area is sometimes called sound flux or acoustic flux through that area.
- Sound power denoted by P

SOUND POWER LEVEL

- Sound power can more practically be expressed as a relation to the threshold of hearing – 10-12 W - in a logarithmic scale named Sound Power Level -Lw, expressed as

Lw = 10 log (N / No)

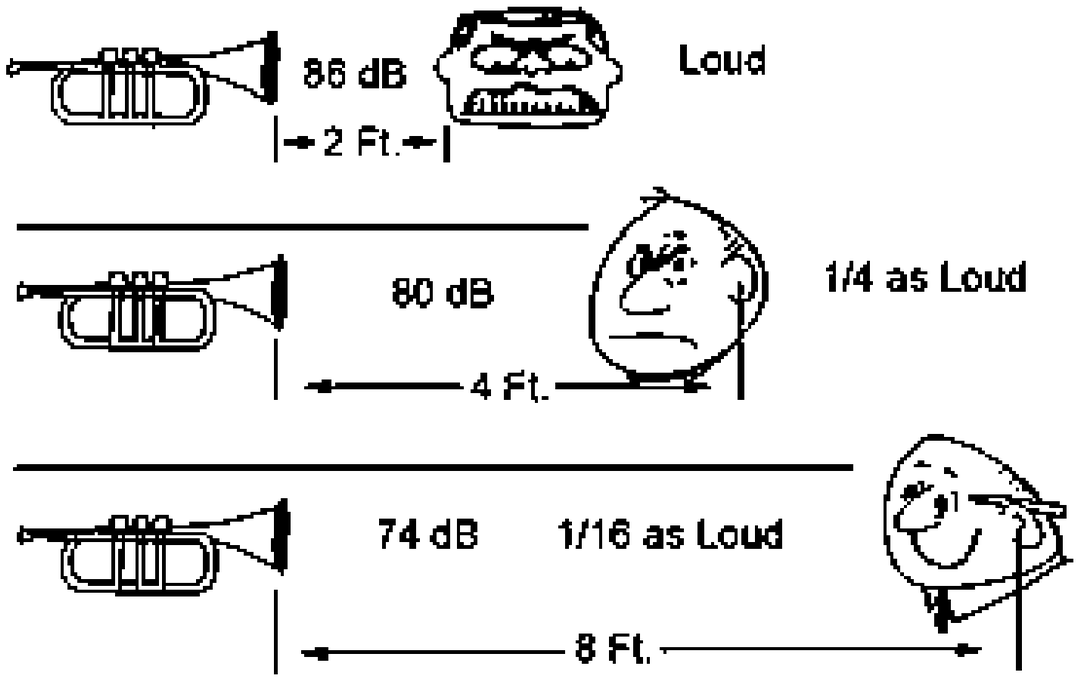
where

Lw = Sound Power Level in Decibel (dB)

N = sound power (W)

No = 10-12 - reference sound power (W).

- Human hearable Sound Power spans from 10-12 W to 10 - 100 W, a range of 10/10-12 = 1013.

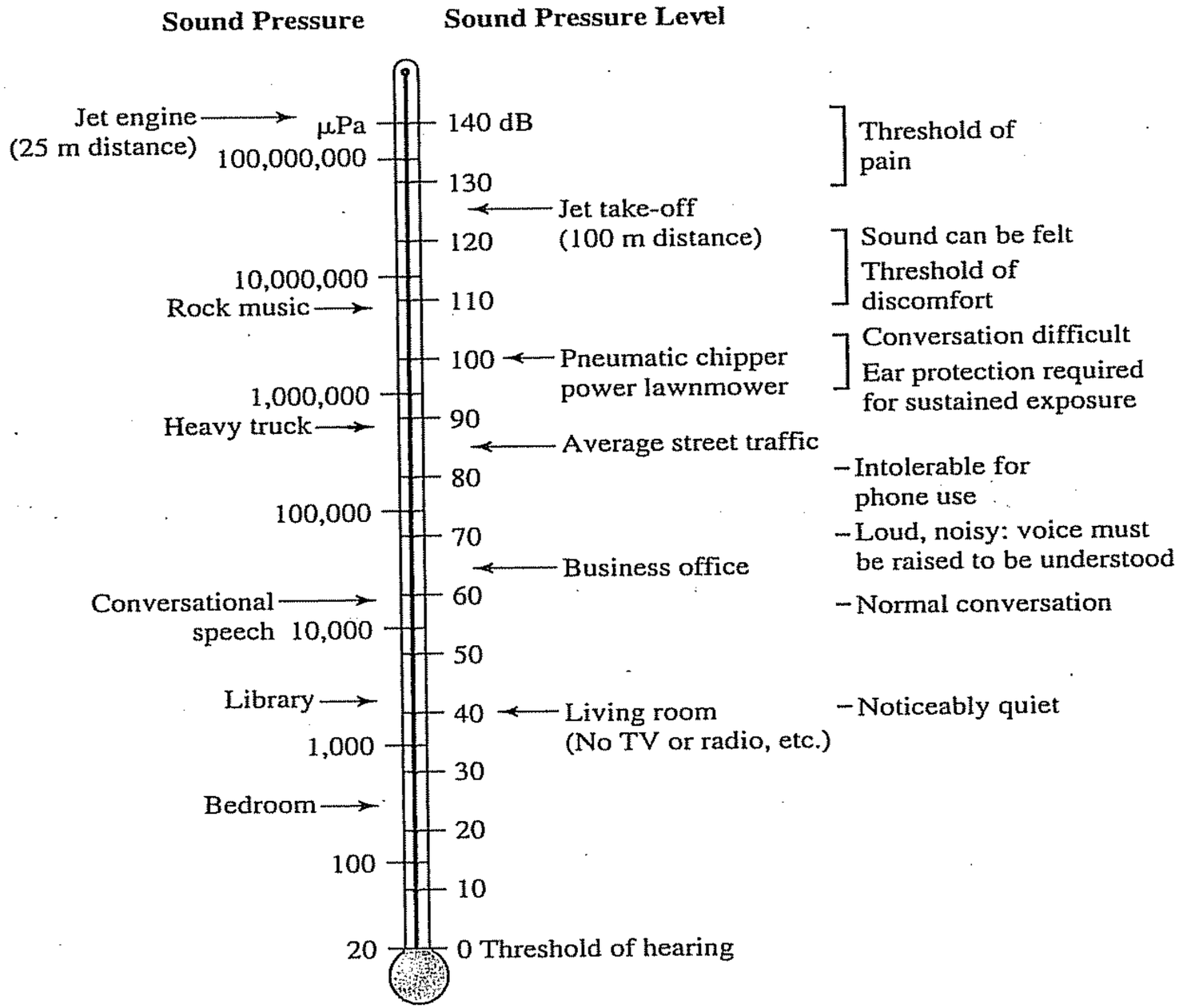


SOUND INTENSITY

Sound intensity also known as acoustic intensity is defined as the sound power per unit area.

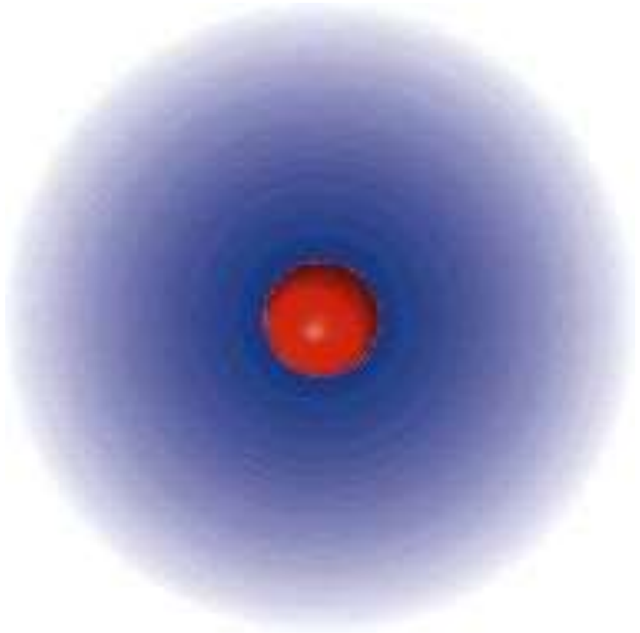
- The usual context is the noise measurement of sound intensity in the air at a listener's location as a sound energy quantity.
- Sound intensity is not the same physical quantity as sound pressure.
- The SI unit of sound intensity is the watt per square meter (W/m2)
- Its denoted by I.

$$Sound\ Intensity\ (I) = \frac{Sound\ Power\ (P)}{Area\ (A)}$$


Sound Pressure
Sound Pressure Level
Jet engine
(25 m distance)
μPa
100,000,000
10,000,000
Rock music
1,000,000
Heavy truck
100,000
Conversational
speech 10,000
Library
1,000
Bedroom
100
20
140 dB
130
Jet take-off
(100 m distance)
120
110
100
Pneumatic chipper
power lawnmower
90
Average street traffic
80
70
Business office
60
50
40
Living room
(No TV or radio, etc.)
30
20
10
0 Threshold of hearing
Threshold of
pain
Sound can be felt
Threshold of
discomfort
Conversation difficult
Ear protection required
for sustained exposure
Intolerable for
phone use
Loud, noisy: voice must
be raised to be understood
Normal conversation
Noticeably quiet

Outdoor and Indoor noise propagation

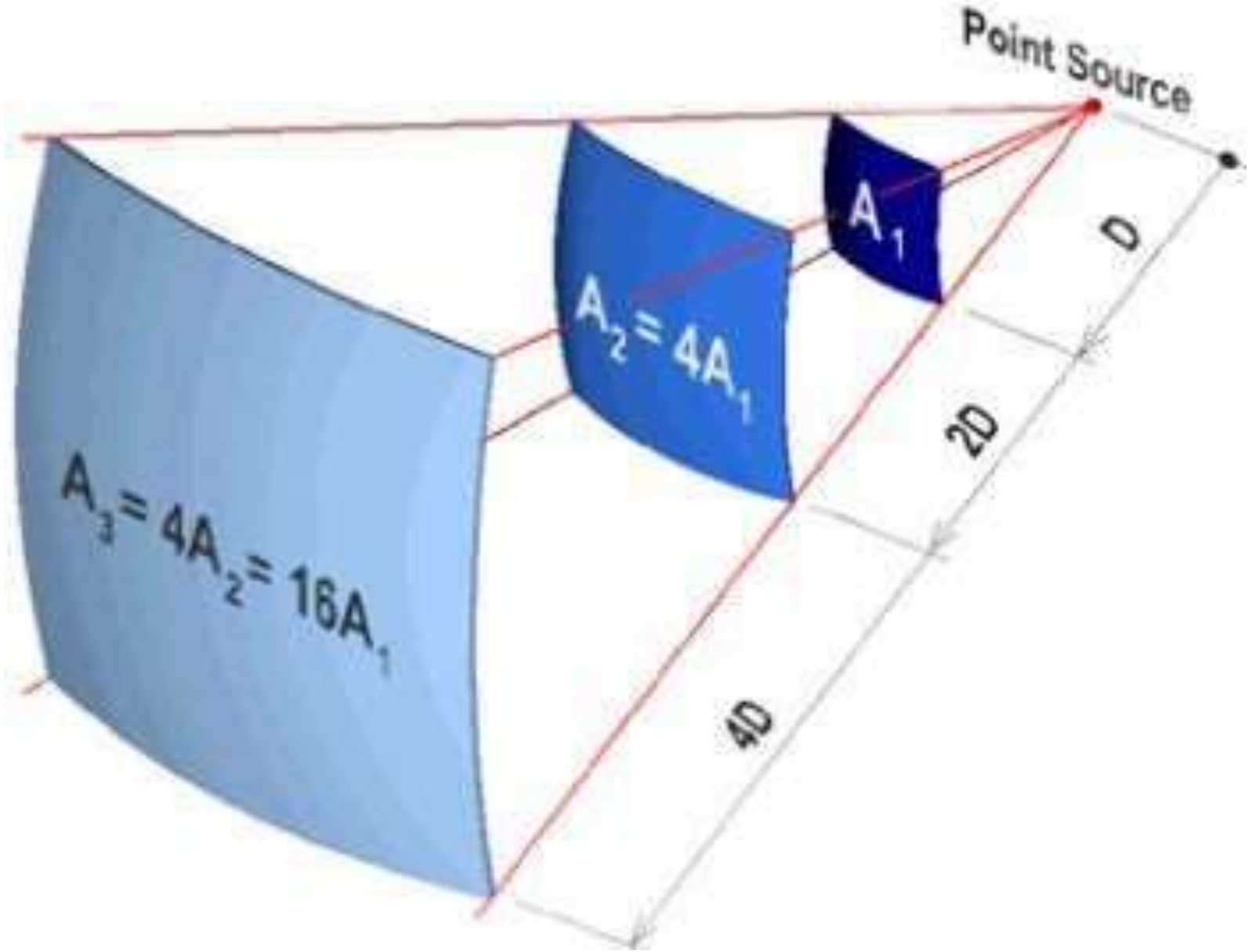
Sound waves emitted from a point source propagate spherically - equally in all directions - from the source.



Outdoor Noise propagation

- Outdoors, sound waves travel in a continuously extending spherical wavefront from the source.
- For a point source that emits a certain sound energy, this energy is concentrated in a single point at the source.
- At a distance from the source, the same energy is distributed over a sphere.
- The greater the distance from the source, the larger the surface over which the energy is dispersed.
- This may be illustrated by studying a segment of the expanding sphere.
- The sound energy is dispersed over an imaginary sphere with a surface that grows in proportion to the square of the distance from a point source as shown in figure.

The surface of the sphere grows 4 times with each doubling of the distance from the source. The sound hence rapidly declines with the distance from the source. Each doubling of the distance from the point source yields a 6 dB reduction of the sound level.



Indoor Noise propagation

- Indoors, the sound wave hits building construction surfaces before it is significantly attenuated.
- The sound field indoors is not spherical but depends on the geometry and the acoustical properties of these surfaces.
- The volume of the room and the distances between the sound source, the building construction surfaces and the listening point are also important.
- The sound in a certain listening point in a room is composed of the direct sound and the reflected sound. The direct sound is the sound that has not yet been reflected in a surface.
- The sum of all reflected sound is called the reverberent sound field. It consists of all sound that has been reflected once, twice or more in the building construction surfaces. The sound reflected one time is called 1^{st} reflections, two times 2^{nd} reflections etc.

Psychoacoustics

- Psychoacoustics is essentially the study of the perception of sound. This includes how we listen, our psychological responses, and the physiological impact of music and sound on the human nervous system.
- Hearing includes the mechanical wave propagation and a sensory and perceptual event. When sound arrives at the ear, it is transformed to neural action potential.
- The ear has a nonlinear response to sounds of different intensity levels; this nonlinear response is called loudness.

Applied psychoacoustics

Sound localization

Sound localization is the process of determining the location of a sound source. The brain utilizes subtle differences in intensity, spectral, and timing causes to allow us to localize sound sources.

Sound masking

Sound masking is a weaker sound is masked if it is made inaudible in the presence of a louder sound.

Psychoacoustic Model

The **psychoacoustic model provides for high** quality lossy signal compression by describing which parts of a given digital audio signal can be
removed (or aggressively compressed) safely — that is, without significant losses in the (consciously) perceived quality of the sound.

Compression is a feature of nearly all modern lossy audio compression formats.

REFERENCES/BIBLOGRAPHY

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Thank you!

STAY HOME, STAY SAFE