HOW TO STUDY NOISE

by Ricky Lau

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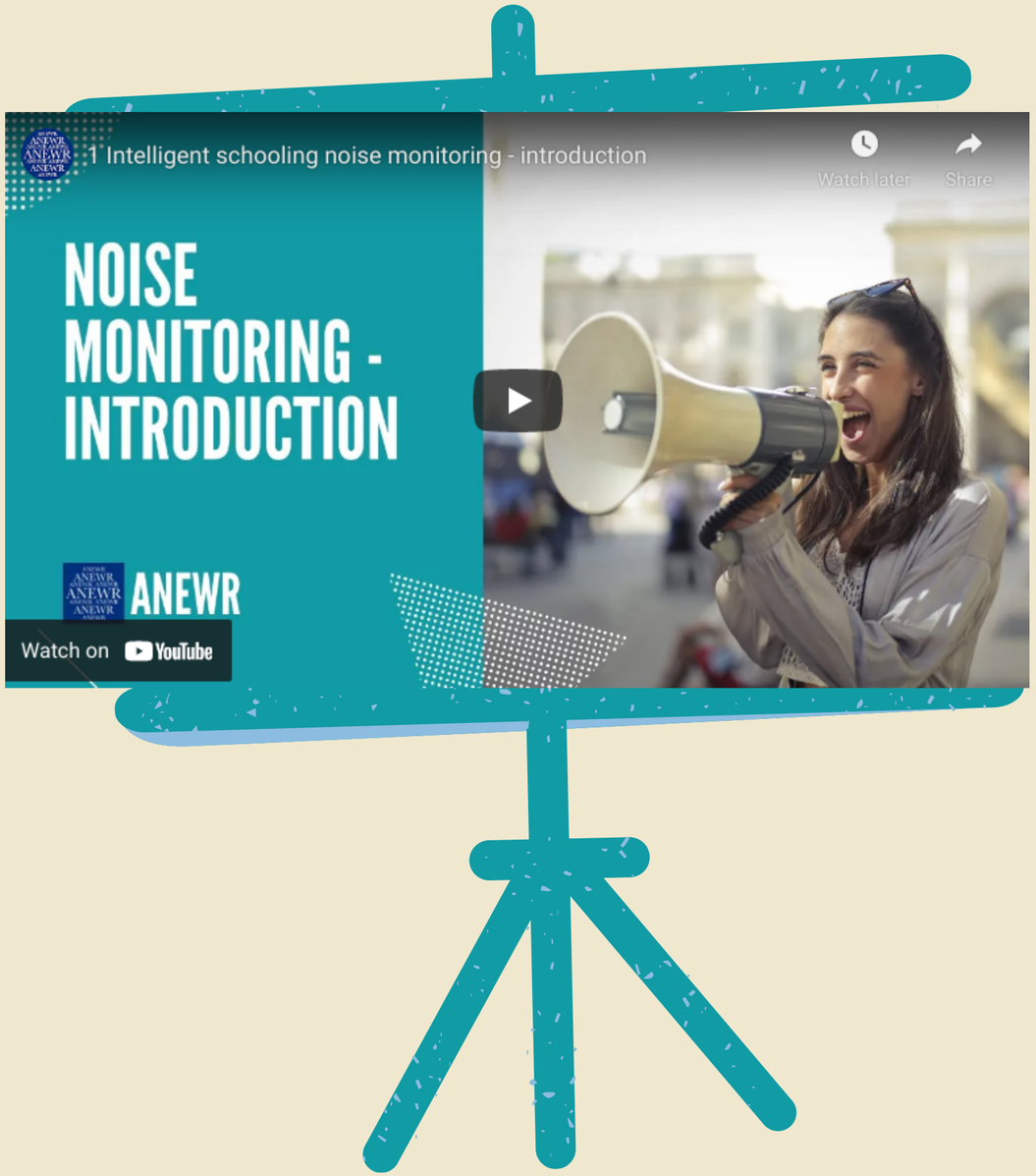


LESSON OBJECTIVES

Understand the theories of the noise, why we need measure noise, and how to do it.

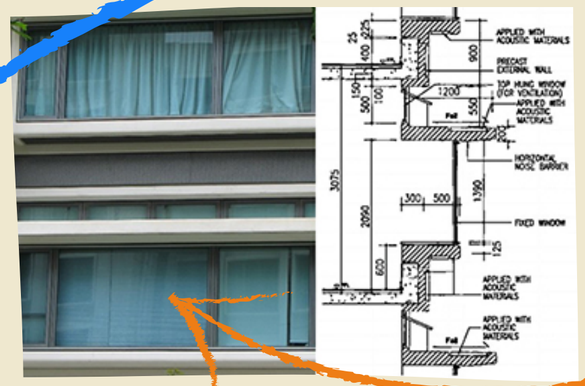
Do you know?
Your built environment;
How to scientifically monitor data;
How to do analysis.

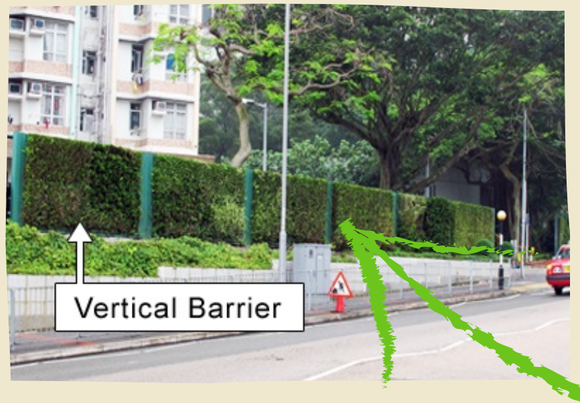
LET'S ACT TOGETHER.

Activity Task

- Observe your environment;
- Identify the noisy areas you would like to monitor;
- Know your noise monitoring device;
- Set up the noise monitoring station;
- Learn the dashboard to record the data;
- Brief about noise monitoring factors and mitigation measures.

PICTURE HUNT - DO YOU FIND THE FOLLOWING MITIGATION MEASURES AROUND YOU?





Source:EPD

Setback;

Single aspect design;

Fins;

Acoustic windows and balcony;

Low Noise Road Surfacing (LNRS);

Barriers.

FAQ

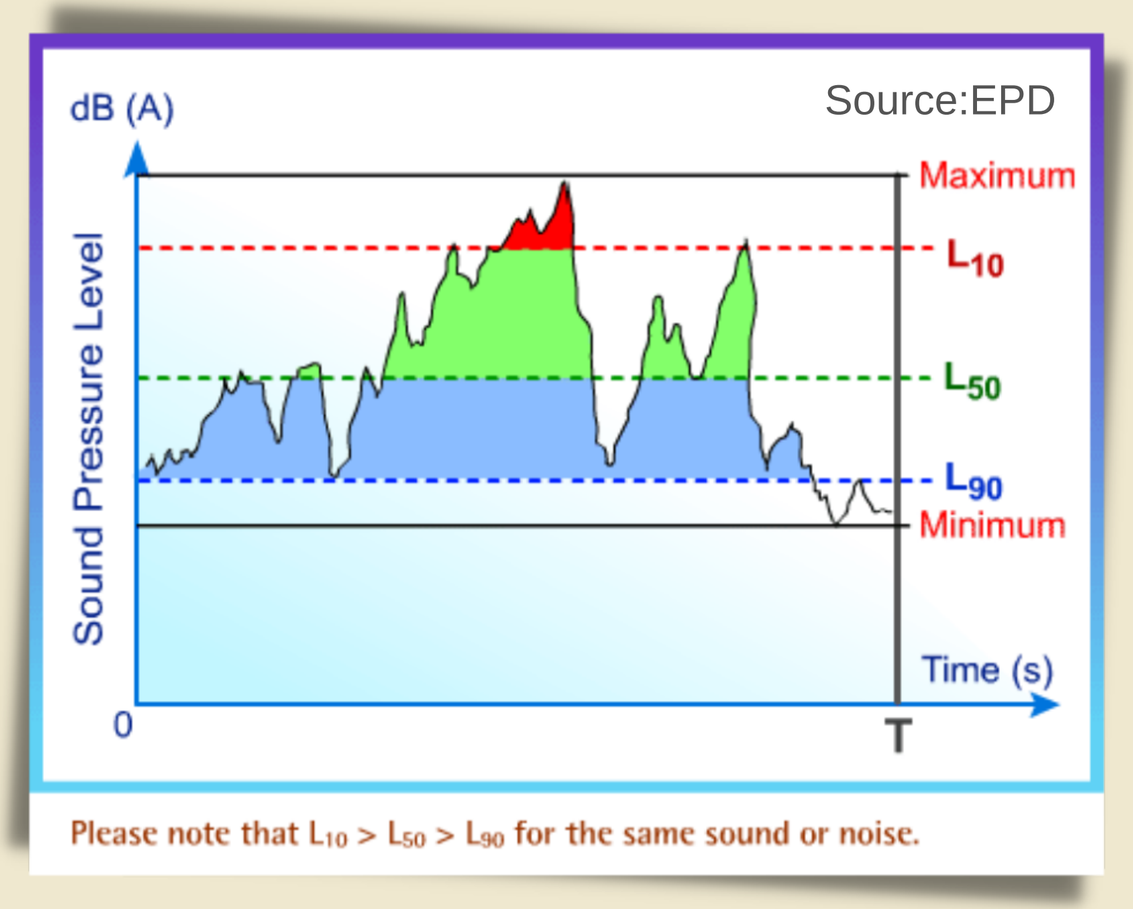
BEFORE WE BEGIN, THINK ABOUT THIS:

Why do we need noise measurement?

NOISE VS. OUR LIVING ENVIRONMENT

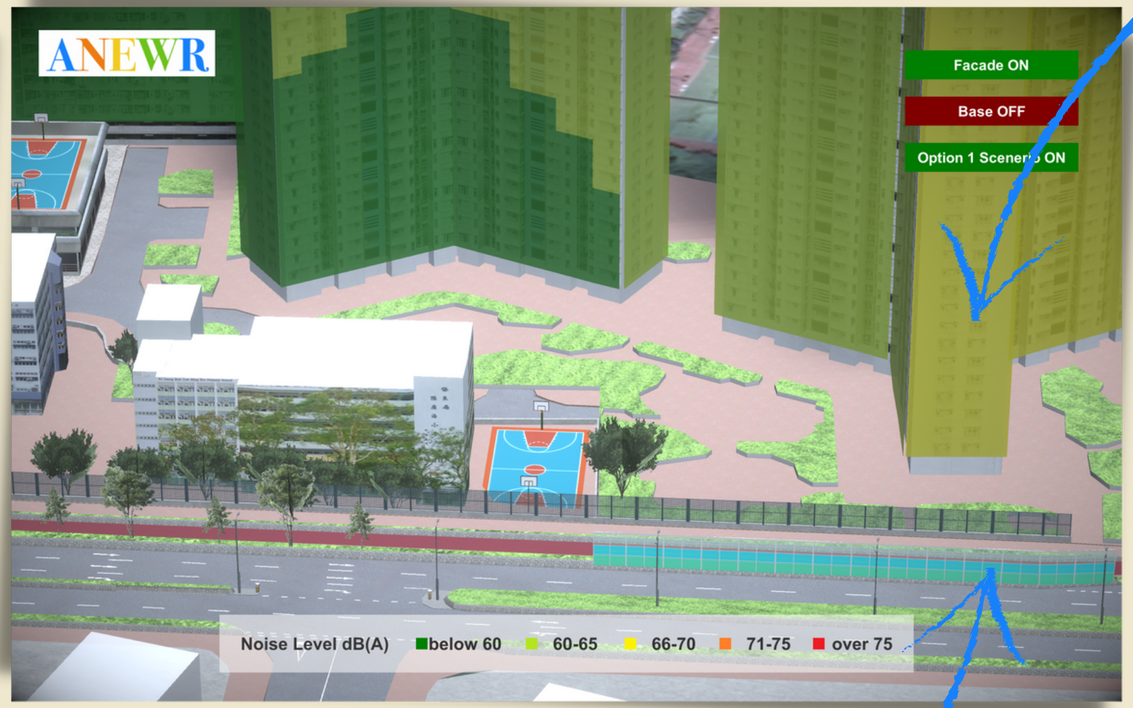
- Noise is bad for our health. But what causes a noisy living environment?
- Vast population on limited land;
- Available housing development sites are close to the heavy traffic roads and railways;
- We love convenience, but housing developed in the present urban area will be unavoidable within the dense traffic area.

NOISE VS. OUR LIVING ENVIRONMENT



- Environmental professionals can advise many noise mitigation measures;
- Some methods are found to protect residents from traffic noise above 70dB(A) of L10 for 1-hour period and from construction noise above 75dB(A) of 30-minute average noise level;
- Innovative noise mitigation measures are greatly needed to be researched and developed to further reduce the percentage of the population exposed to traffic noise.

PICTURE HUNT -
DO YOU "SEE" THE EFFECT OF MITIGATION MEASURES?



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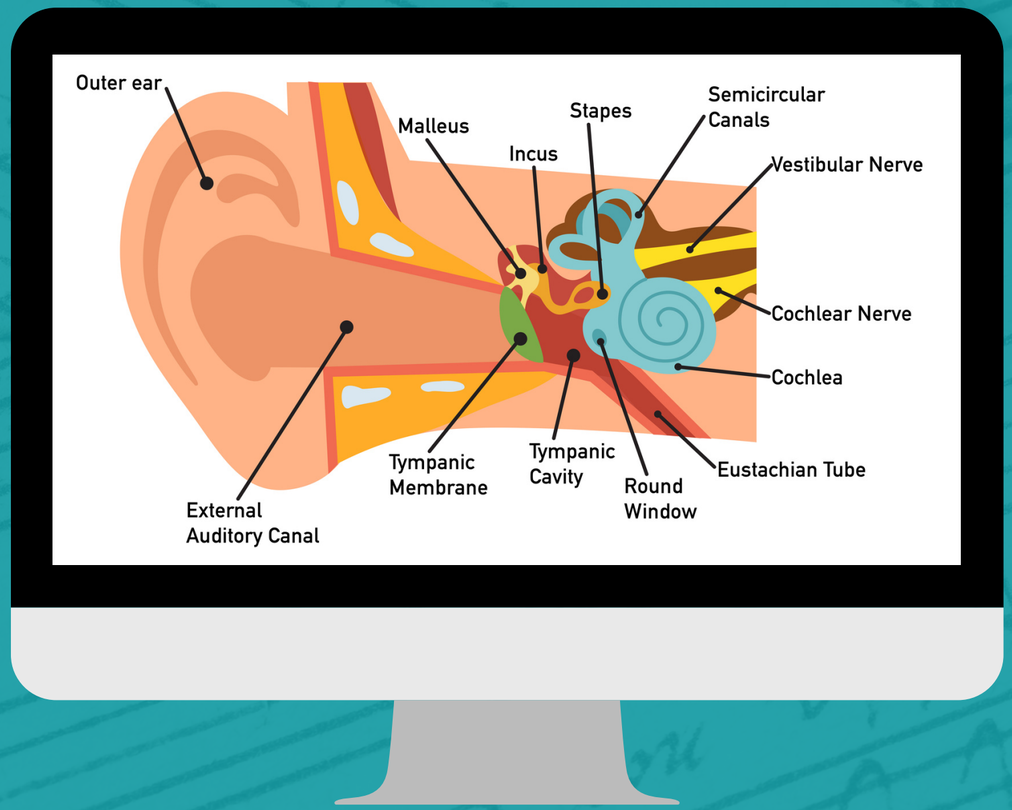
CONCEPT OF SOUND

WHAT IS SOUND?

Transformation of vibration into sound waves



- The mechanical vibration of a gaseous, liquid or solid elastic medium through which energy is transferred away from the source by progressive sound waves;
- The human hearing mechanism;
- Hertz - the frequency of the sound;
- Can we hear ultrasound?

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Sound is omnidirectional

THE LEVEL OF SOUND. INTRODUCING DECIBEL (DB)

- dB expresses a ratio between received and transmitted signal strength;
- Weber-Fechner Law;
- Sound Power Level Vs Sound Pressure Level.

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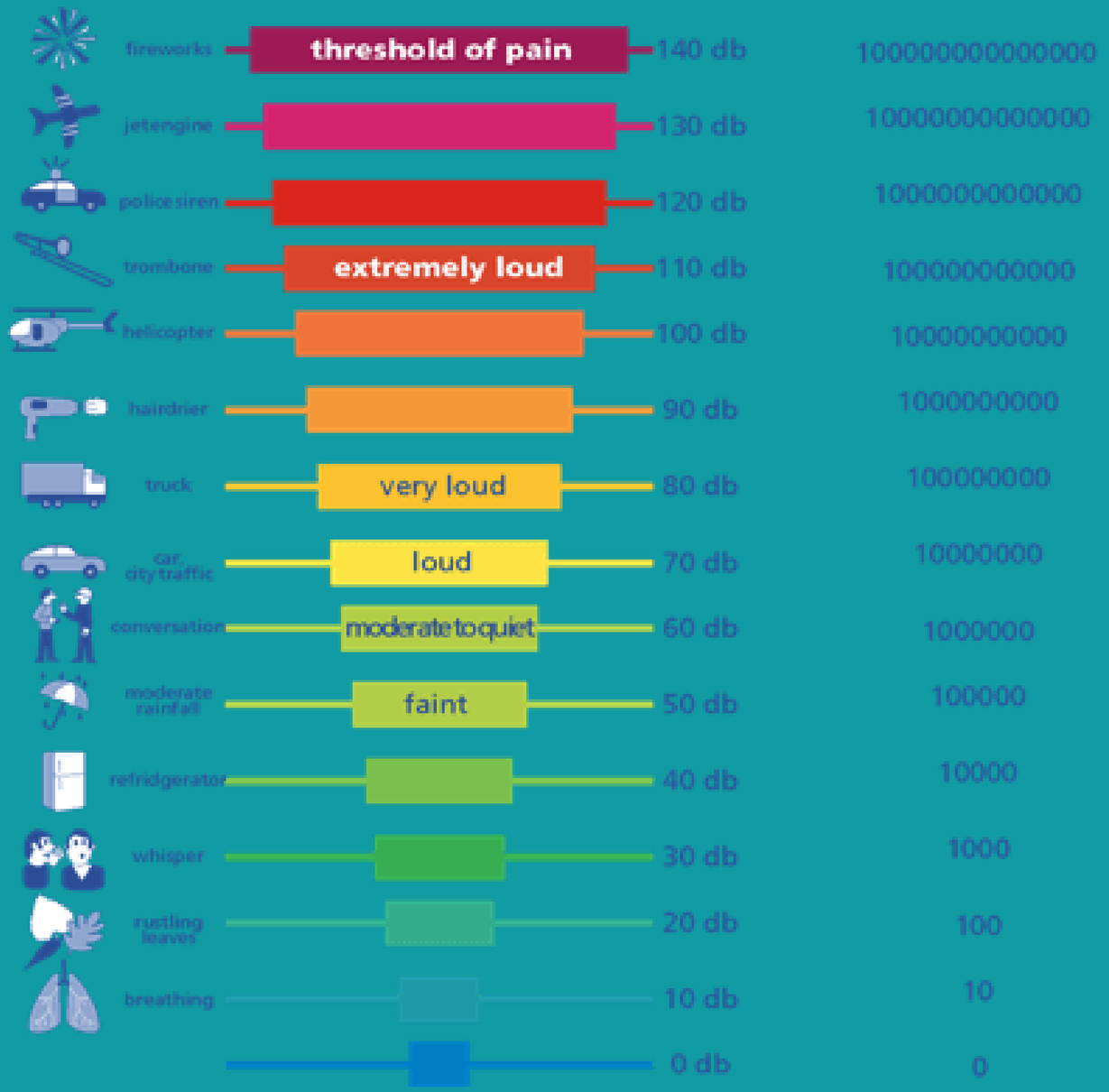
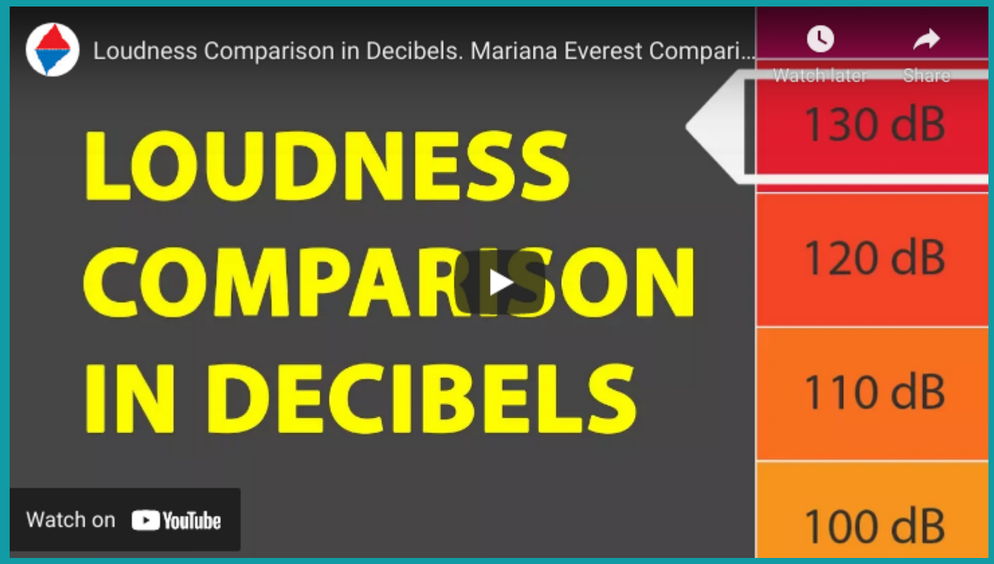
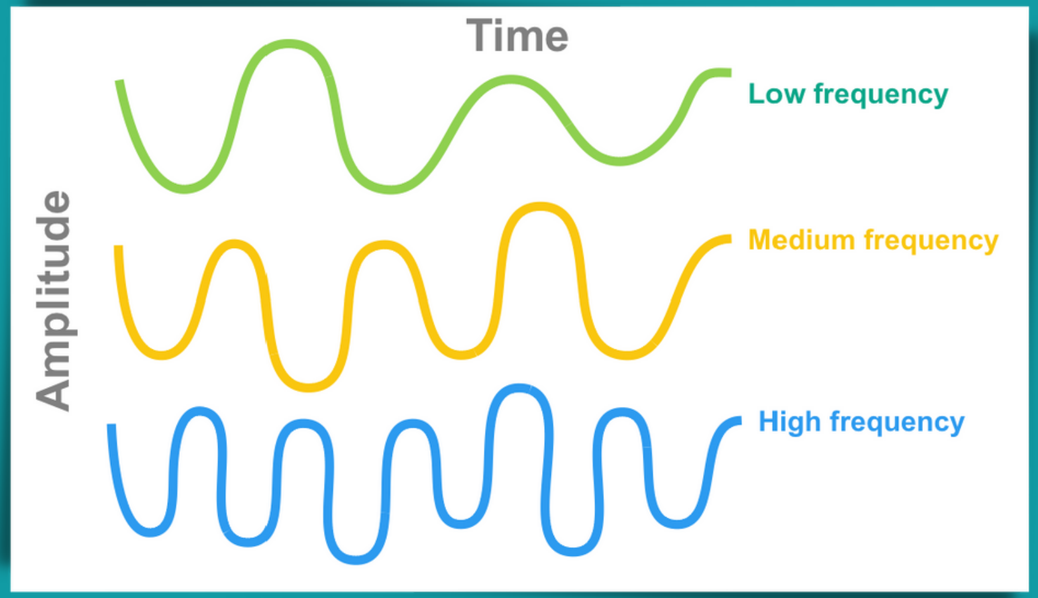
THE LEVEL OF SOUND. INTRODUCING DECIBEL (DB)

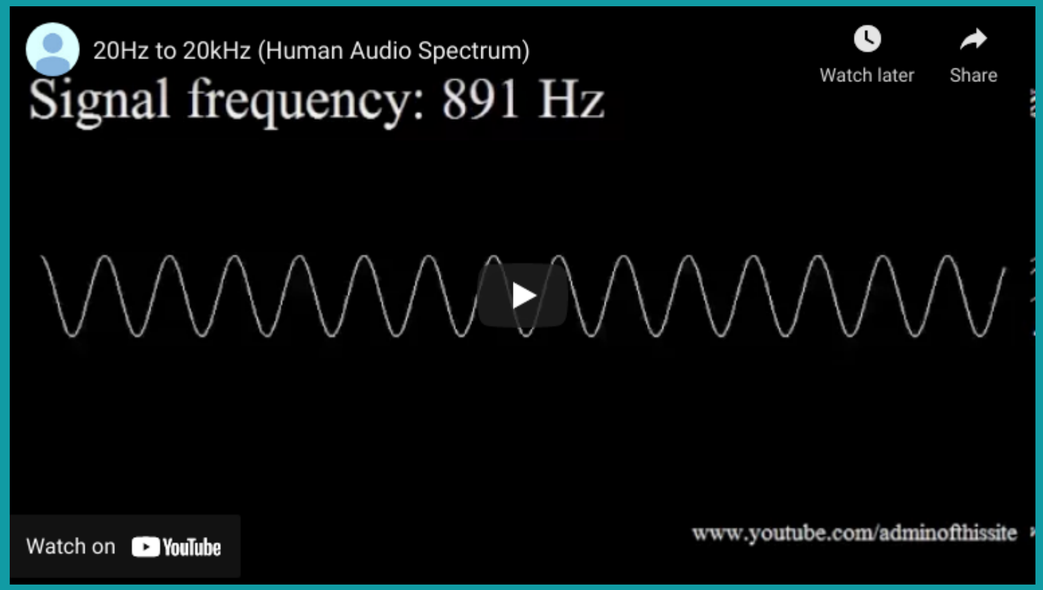


Source: commodious



Source: Mariana Everest Comparison





Source: adminofthissite

THE LEVEL OF SOUND. INTRODUCING FREQUENCY (HZ)

Hertz (Hz)

The number of cycles of wave undergone during one period of time

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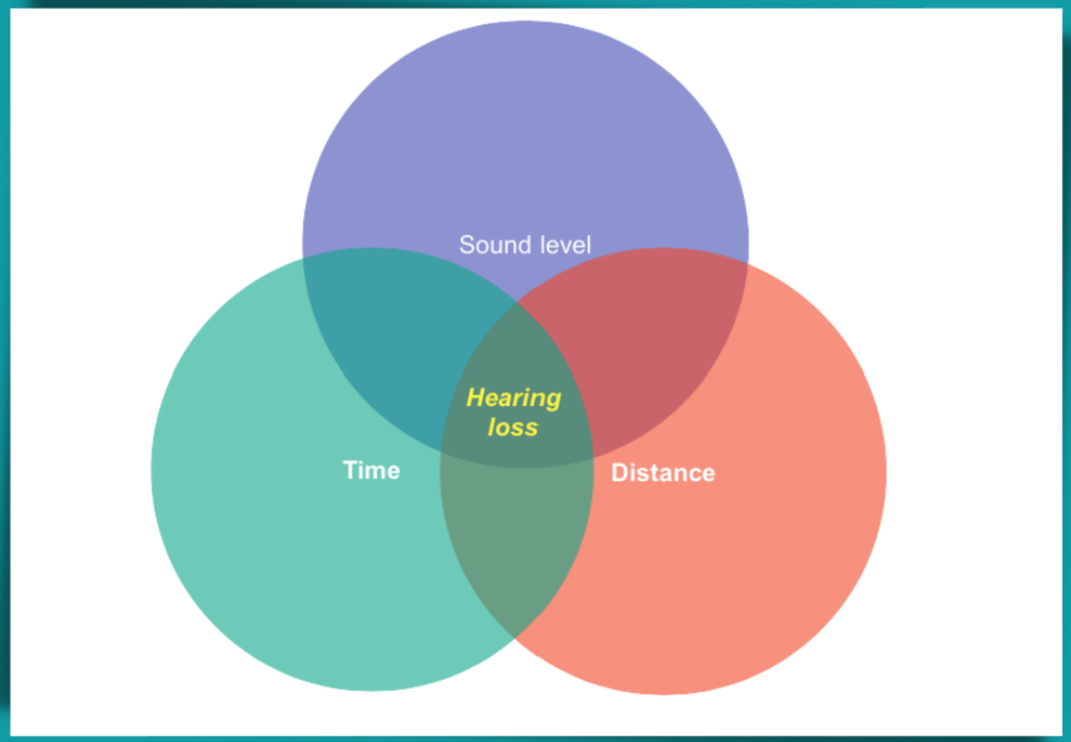
CONCEPT OF NOISE

HOW DOES NOISE AFFECT US?

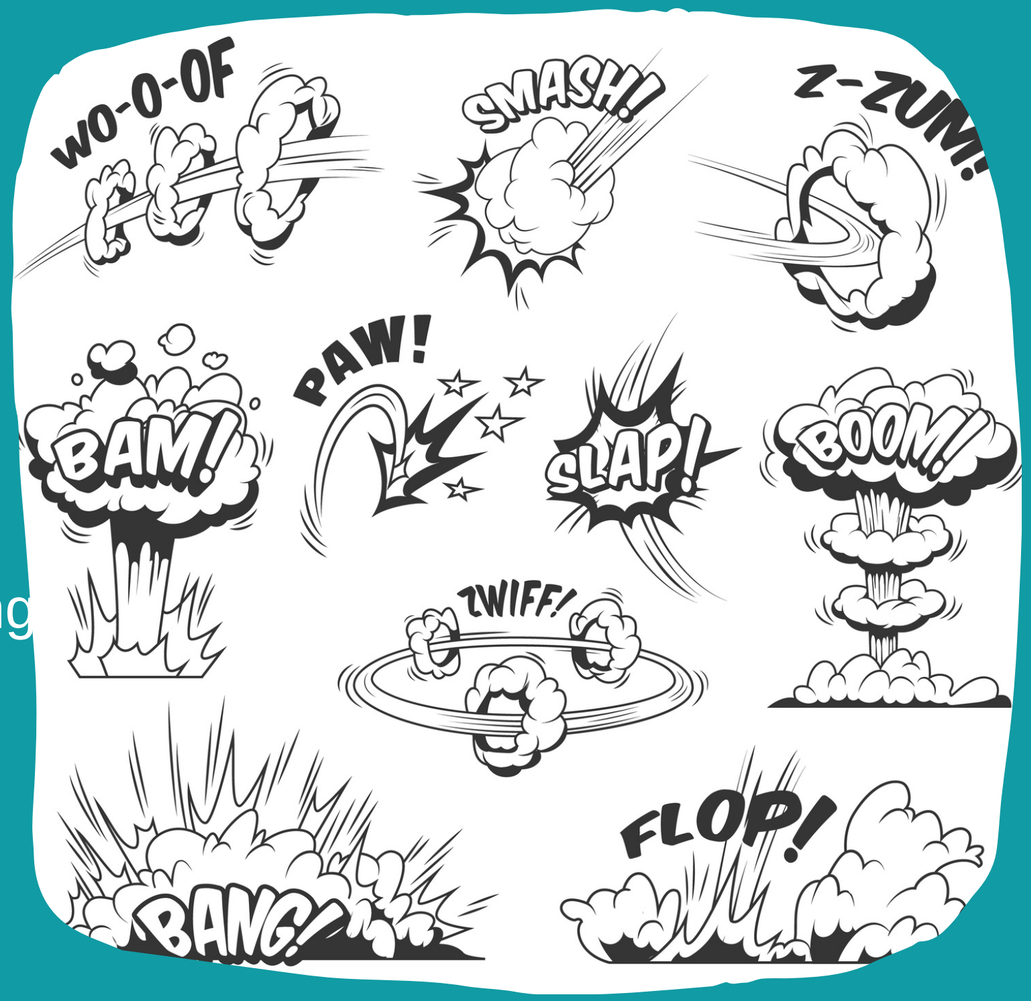


Noise factors to cause damage to our hearings:

- How powerful is the sound? Sounds at or below 70 dB are generally considered safe.
  - Any sound at or above 85 dB is more likely to damage your hearing over time.
- How close is the source of the sound?
- How long do you expose to the sound?
  - Noises are more likely to damage your hearing if they are:
    - 85 dBA and last a few hours
    - 100 dBA and last at least 14 minutes
    - 110 dBA and last at least 2 minutes

WHAT EXACTLY IS NOISE?

- Is it only about loudness?
- It is an unwanted sound, connected with the feeling of annoyance;
- In connection with **when** and **where** it occurs.



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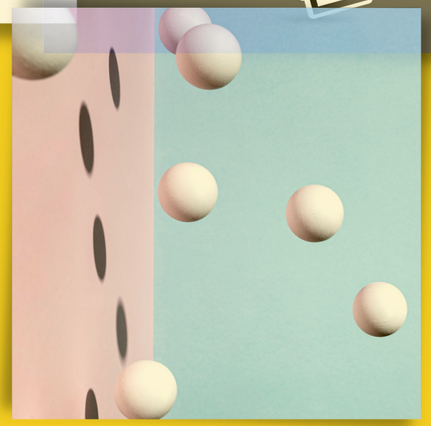
IMPLEMENTATION

THE POINTS WE NEED TO PAY ATTENTION TO WHEN OBSERVING THE ENVIRONMENT



- How many noise sources can you find in the environment?
- What characteristics do the noise sources have?
- Which location at the school can we pinpoint most of the noise sources?
- At the above location, which directions do the noise sources come from?
- At the above location, how far apart are the noise sources?
- At the above location, are there any walls/structures that may cause reflection?

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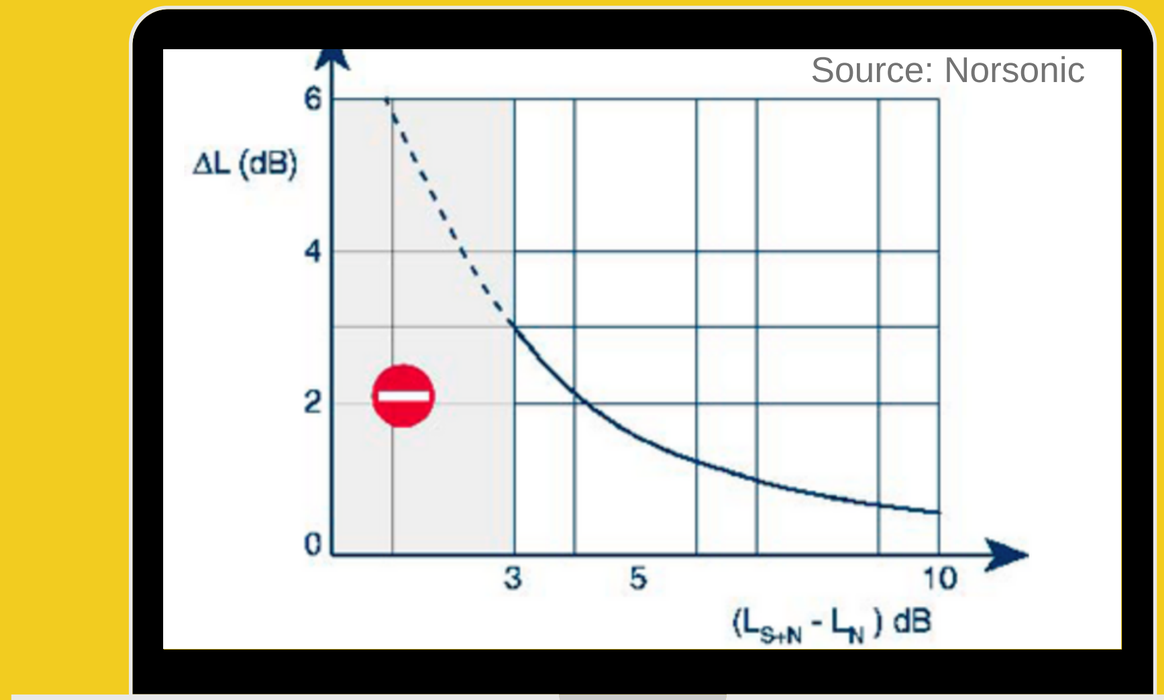
WHY BACKGROUND NOISE MATTERS?

- It may drown out the noise from the item you want to measure;
- It simply cannot be turned off;
- Creates a need to correct the influence of the background noise on the overall noise level.



$$L_{total} = 10 \log (10^{L(S+N)/10} - 10^{L(N)/10})$$

L(S+N): Noise Source+Background Noise
L(N): Background Noise

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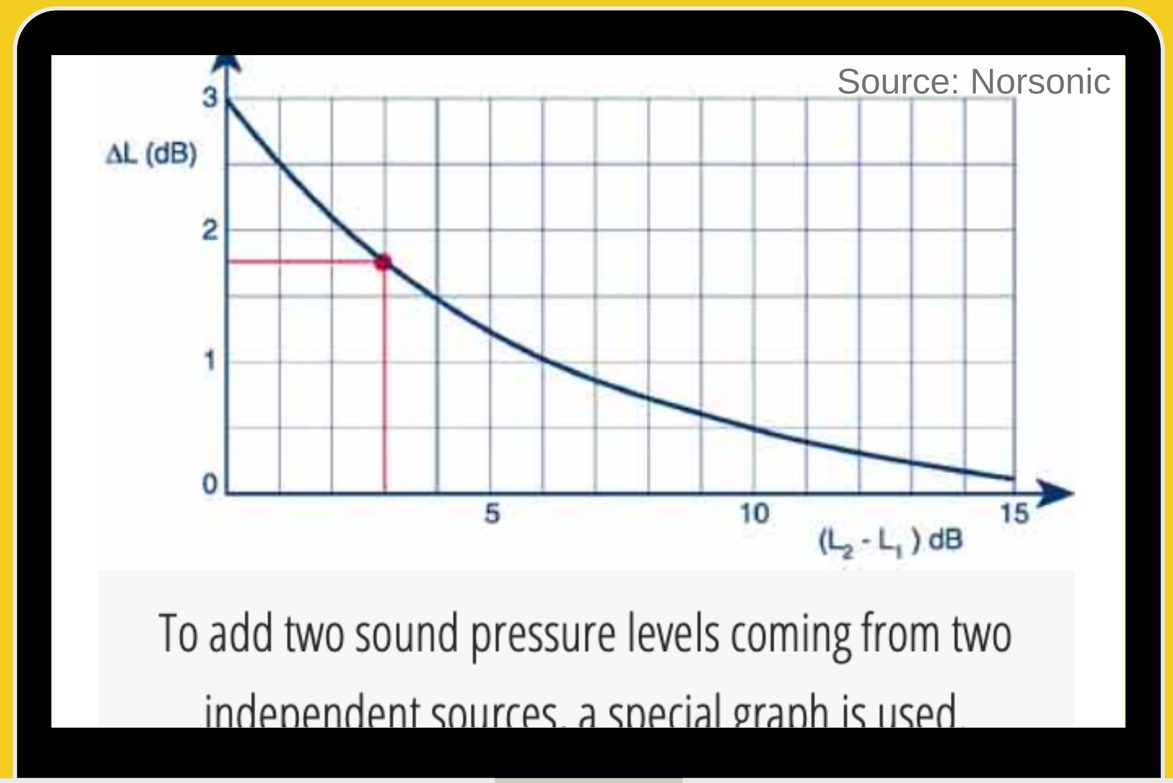
WHAT HAPPENS IF WE HAVE MORE THAN ONE NOISE SOURCE IN THE ROOM?



$$L_{total} = 10 \log (10^{L1/10} + 10^{L2/10})$$

L1: Noise Source 1
L2: Noise Source 2

Is the result the sum of the individual sound pressures?

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THE EXTERNAL FACTORS AFFECT THE MONITORING

- The angle we are placing the meter;
- The weather;
- The background environment.

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WHAT ARE OUR EQUIPMENTS?

For noise measurement.

1) Sound Level Meter;

2) Associated noise station box kit and setup tools;

3) Dashboard.

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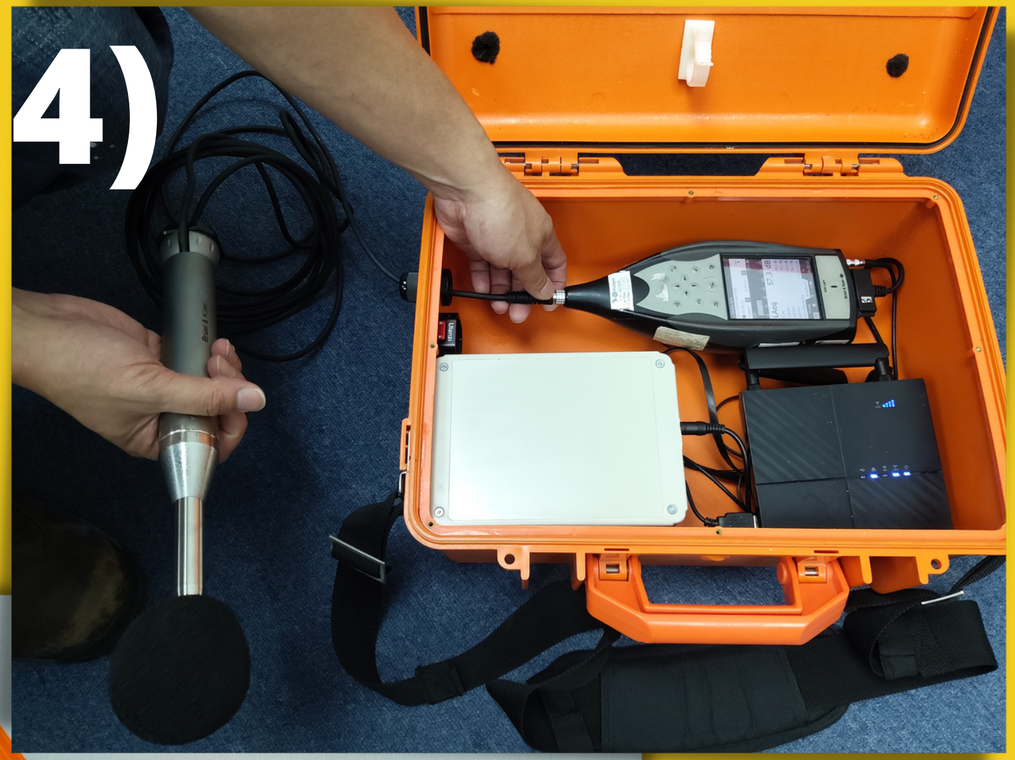

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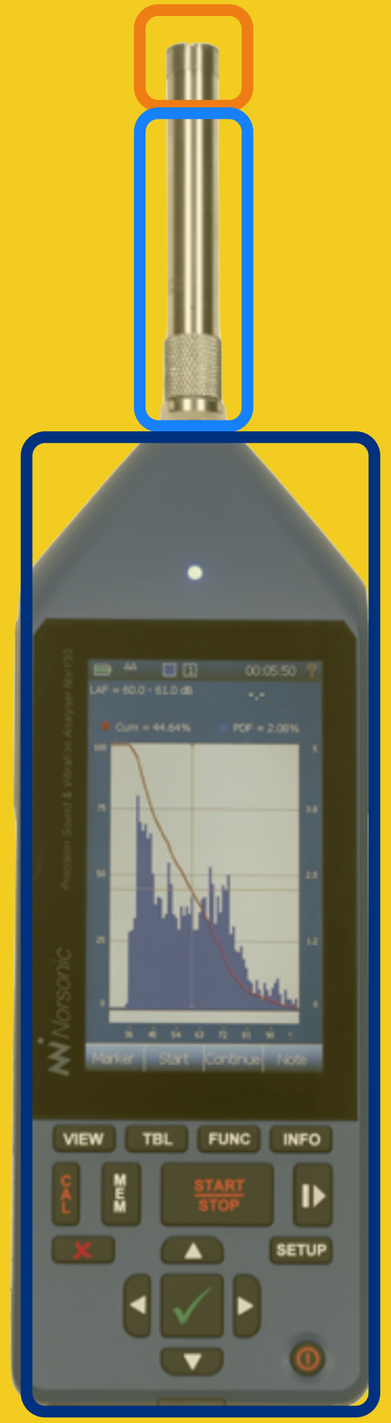

WHAT IS SOUND LEVEL METER?

It hears the way we do.

- The unlinearities of our hearing weighs on some parts compared to other parts;
- A Sound Level Meter with such a weighting network built-in;
- Noise abatement measures.

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WHAT DATA DO WE RECORD AND HOW TO UTILISE THE DATA FOR ANALYSIS?

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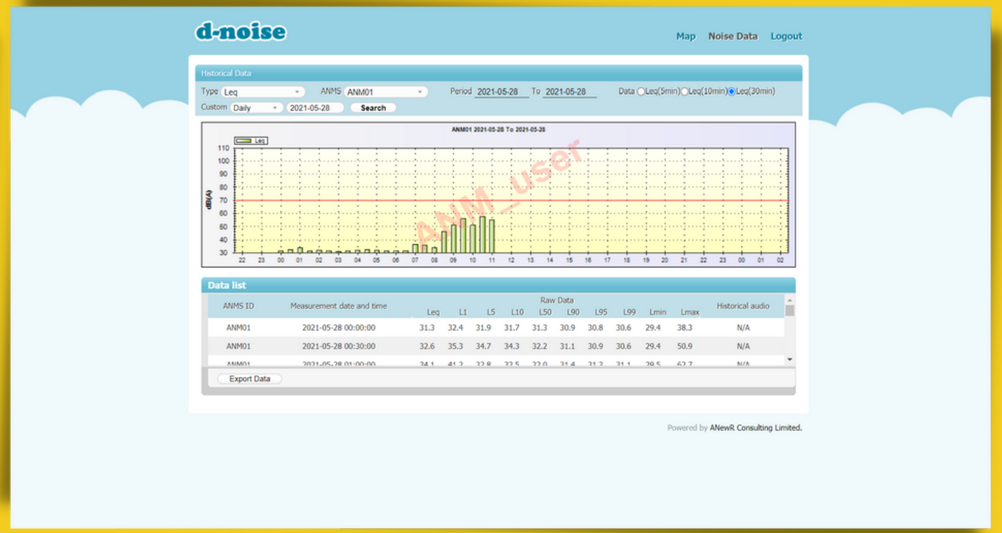
- Real-time measurement (dB);
- Web-based monitoring (Human Resources saving);
- Data retrieval (Date, time, dB);
- Station list with map (location);



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IDENTIFY THE BEST LOCATION FOR PLACING THE MONITORING STATION

- Cover most of the noise sources;
- Close to most of the noise sources;
- No wall/structure that may cause reflection;
- Location with less human activities;
- Stable electricity supply;
- Good signal;
- Safe to access.

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ANY QUESTIONS?

Don't hesitate to reach out for questions or clarifications

QUIZ

- What factors would affect the noise measurement result?
- Are sound power and sound pressure the same?
- Can we just add up two independent sound levels we find in a room?
- What is decibel (dB)?
- Is low frequency easier to cope with than high frequency?
- How do you define the best location to place the noise monitoring station?
- Why does background noise matter to noise measurement?

EXPERT TALKS – WHY ENVIRONMENTAL MONITORING MATTERS AND HOW WE DO

LECTURE #1

Keeping Traffic Noise in Hong Kong – Feasible or Impossible

Maurice Yeung, ASA ESEA
English

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LECTURE #2

Noise Policies in Thailand – Case Studies

Michel Rosmolen, Geonoise
English

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LECTURE #3

Noise Assessment Practices

Franki Chiu, ARUP
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LECTURE #4

Industrial Noise Control – Creativity and Innovation

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