Measuring Environmental Noise

Contents:

- Environmental noise measurement equipment (Demo)
- Where and how to measure environmental noise
- Sources and receptors

Environmental noise measurement equipment

*Equipment requirements for the environmental noise consultant:

- Sound Level Meter – Type 1 (some regulatory agencies will also allow a Type 2 SLM)
- Sound Level Meter should be capable of measuring the following parameters:
  - Equivalent sound level – Leq
  - Fast, slow and impulse time weightings
  - Sound exposure level – LEq
  - Maximum noise level – Lmax
  - Statistical Levels – L%
  - Day/Night sound level – LDN
  - Third octaves – FFT – desired
  - Beneficial if vibration sensor capable for ground vibration measurements
- Calibrator
- Outdoor microphone and storage system for long-term monitoring
- Weather station – handheld
- Tripod
- Distance measurement equipment, i.e., tape, laser range finder, etc.
Environmental noise measurement equipment

- Sound level meters can be Type 0, 1, 2, and 3.
- Should comply with IEC 60651 and IEC 60804. A new draft standard, IEC 61672, will replace the previous two standards (elimination of Type 3 meter).
- It is essential that a calibrator be included in any measurement system.
- A calibration check should be performed before and after each measurement session to ensure confidence in the data.
- Factory calibration should also be done annually for legislation compliance.

Environmental noise measurement equipment

- Unattended monitoring should be conducted with an appropriate microphone and storage system. i.e. outdoor mic with rain shield, bird spike and pelican case or similar.
- Might include weather monitoring, data logging and event trigger. May also have GPS, automatic calibration and sound recording capabilities. Need good power supply.
- Software management and tools
  - Complaint handling
  - Action plans
Environmental noise measurement equipment

- Accessories:
  - Handheld weather station with wind speed, temperature and humidity capabilities
  - Good sturdy tripod. Most measurements will be conducted at a height of 1.5 metres
  - Measuring tape and laser range finder for distance measurements
  - Two-way radios for measurement coordination
  - Lots of spare batteries
  - Locks and chains

Where and how to measure environmental noise

One of the most difficult tasks in conducting environmental noise measurements is to determine where the measurements should be made.

*Source measurements:
  - Should never be conducted in the near-field
  - Important to eliminate any other nearby sources
  - Good practice to take multiple readings at distances double the previous
  - Consideration must be given to directivity of the source and reflectivity of the surroundings
  - Document everything with lots of photographs

*Receiver measurements:
  - While not as useful due to extraneous sources, these are often required to meet regulations
  - Usually conducted at either the receiver property line, outdoor living area or plane of an open bedroom window
  - Important to get homeowner permission
  - This often includes unattended monitoring
  - Beware of large (noisy) dogs
Sources and receptors

• Sources of environmental noise include:
  * Industrial facilities
  * Road traffic noise
  * Rail traffic noise
  * Aircraft noise

• Receptors are classified as places of residence and relaxation:
  * Houses, apartments, condominiums
  * Hospitals
  * Schools
  * Cottages and resorts

• Consideration must be given to what receivers are considered for noise impact from a given source. This is usually dictated through legislation (often 300 to 500 metres from a source).

Brüel & Kjær in the Environmental Market

Brüel & Kjær products, such as sound-level meters and accompanying software, are used for assessing environmental noise and noise at work

- Noise monitoring in airports and large cities - hundreds of installations at public and private organisations

- Noise assessment by authorities worldwide - thousands of local, regional, and national authorities

- Occupational noise monitoring by authorities, insurance companies, or industrial businesses
Range of Environmental Products

Noise Measurement / when, where, why
Odd Noise Measurement Enquiry No 1

- I would like to measure the noise level of women grunting
Odd Customer Enquiry No 1

- I would like to measure the noise level of women grunting

Model 2240

Construction Noise

- Perimeter Noise Level < 67dB
- Monitoring Period, 18 Months
- Weather protected
- 1 hour averages with max level
- Battery power
SLM & Analyser portfolio

<table>
<thead>
<tr>
<th>Price</th>
<th>Functionality</th>
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<tbody>
<tr>
<td>2240</td>
<td>Low-end</td>
</tr>
<tr>
<td>2239</td>
<td>Lower mid-range</td>
</tr>
<tr>
<td>2250</td>
<td>Upper mid-range</td>
</tr>
<tr>
<td>2250 light</td>
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</tr>
<tr>
<td>2270</td>
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2250 & 2270 - toolbox of applications

- BZ 7222 Sound Level Meter Application
- BZ 7223 Frequency Analysis Application, CPB
- BZ 7224 Logging Application
- BZ 7226 Signal Recording Application
- BZ 7225 Enhanced Logging Application
- BZ 7227 Reverberation Time Module
- BZ 7230 FFT Analysis Application
- BZ 7231 Tone Assessment
- BZ 7228 Building Acoustics
Construction Noise

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Type 3535 – features

- 7Kg weight specification (fully populated)
- Mains or battery power as standard
- IP 44 water resistant specification
- Accomodates Digi router or Wavecom modem
- 2 low mass, high capacity Li.Ion battery packs
- 4 days continuous battery power
  - Battery power management with 2250 timers
  - For example for 9am to 5pm monitoring yields 12 days of power or 14 days if Saturdays and Sundays excluded.
  - Timers to be included in 2250 L setup from June 2009

Type 3535 All Weather Case supplied as standard with two batteries, two chargers, power panel and all internal wiring
Broadband communication with 2250/2270

Corporate Office

Internet

BZ 5503
PC software

2250/2270 with 3G router

Remote Site

Web browser access to Type 3535 system

Internet

PDA with internet access

Mobile phone internet access

3G/GPRS

Remote Site

PC with web browser

51.6dB
The Connectivity Perspective

“A USB or Ethernet cable the length and breadth of the globe....”

Odd Noise Measurement Enquiry No 2

- How to determine political popularity using acoustics
Odd Customer Enquiry No 2

- How to determine political popularity using acoustics

Model 2250 Light

Building Acoustics

- Sound Insulation must be >53dB
- Easy to Use
- Portable and Rugged
SLM & Analyser portfolio

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2250 light

2238 lower mid-range

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- BZ 7229 Dual Channel Building Acoustics
Building Acoustics

- Sound Insulation must be >53dB
- Easy to Use
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Model 2270

New Measurement Capability –

- Loudness and Loudness level
  - Psychoacoustic index for loudness in machinery/Automotive
- NR and NC according to ANSI
  - heating and ventilation system acceptance testing in US & Asia
- Customised band limited Leq
  - to address requirements of national standards in Asia
SLM Technology – has it advanced that much?

- Sound Level Measurement
- Averaging
- Image Capture
- Level against Time display
- Statistical Analysis
- Signal Generation
- Calibrator

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Domestic Noise

- Neighbour Noise at unsociable hours
- Unpredictable occurrence
- Residents very frustrated

SLM & Analyser portfolio

Price

2240 Low-end
2239 Low-end
2250 light lower mid-range (noise at work)
2270 2 Channel upper mid-range
2238 lower mid-range (env. monitoring)
MATRON - Neighbour Noise Nuisance Recorder

MATRON system using 2250

Domestic Noise

- Neighbour Noise at unsociable hours
- Unpredictable occurrence
- Residents very frustrated
Odd Noise Measurement Enquiry No 4

- Who can sing the highest note at the BBC Fame Academy

Odd Customer Enquiry No 4

- Who can sing the highest note at the BBC Fame Academy

Model 2260
Odd Noise Measurement Enquiry No 5

- Consumer test – is the new Toyota iQ quieter than a bicycle

Summary – Tips for The Environmental Engineer

- Check that your instrumentation is in good working order, use a wind screen
- Check the battery levels of the sound level meter and calibrator
- Make sure to calibrate your instrument at the beginning and end of the measurement session
- Check the applicable standards for appropriate measurement equipment and techniques
- Select the correct time constant i.e. fast, slow or impulsive
- Make sure to measure all of the appropriate noise metrics e.g. Leq
- Check the background noise level
- Pay attention to the weather conditions and record them
- Mount the sound level meter on a tripod or hold at arms length
- Check that you are in the far field and confirm your sound level meter settings
- Repeat measurements when possible and at varying distances
- Keep away from reflecting surfaces during measurement
- Make note of acoustic characteristics of the source e.g. tonality, steady noise, intermittent etc.
- Make a sketch of the area, record all distances and take lots of photographs for your report