Proceedings of the Institute of Acoustics

NOISE MONITORS IN HAZARDOUS ENVIRONMENTS – DESIGNING FOR THE URBAN JUNGLE

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INTRODUCTION

Permanent or semi-permanent noise monitoring systems are becoming increasingly widespread as a tool for the measurement and monitoring of noise levels in both remote and urban environments.

Such systems are ideal for long term monitoring for both compliance with statutory limits, regulations and guidelines as well as for often-essential public relations with local residents and environmental groups.

This paper considers some of the important topics associated with noise monitoring in urban environments, many of which are often overlooked when a noise monitoring system is specified or requested.

HISTORY

Outdoor Noise monitors have evolved from a simple "Sound Level Meter in a box" to sophisticated, purpose designed units boasting the latest technology and all of the measurements that could ever be needed by most acoustic professionals.

The advent of affordable computer hardware in the 1980's allowed the development of Out-box processing using a data logger to store measurements and software to provide a wide range of measurements

With the flow of technology from both the PC world and the mobile telephone industry into the wider world, electronics with lower power consumption and higher processing power has allowed much of the Out-box processing to be carried out in situ, reducing the amount of data that needs to be sent or collected from the noise monitor.

Purpose designed noise monitors have usually been optimised in some way to provide the most efficient measurement of noise, either in terms of size, weight or power consumption.

The majority of outdoor noise monitoring is carried out using one of three types of instrument:

- Sound Level Meters in a box
- Portable Noise Monitors
- Permanent Noise Monitoring Terminals

WHAT'S THE APPLICATION?

The number of applications where a permanent noise monitor or monitoring system is required has increased dramatically.

The largest growth area for this type of monitoring system has been in populated areas where sensitivity to noise is often greatest. However, the locations for this new breed of monitoring system is often the most hostile and hazardous, the urban jungle!

A wide range of other applications has joined the traditional uses for noise monitoring systems, such as airport and aircraft noise. Some examples of where permanent noise monitoring systems have been recently installed include:

- Petrochemical & Chemical Production Sites
- Power Stations Construction & Operation
- Road & Rail
- Construction Sites
- Open Cast Mining

WHAT MEASUREMENTS ARE REALLY NEEDED?

Although the number and type of measurements that are available from a modern noise monitor have increased, the basic noise parameters that we use are still often the most important.

In many applications, a long-term noise monitor may only need to download the basic acoustic parameters such as Leq, Lmax and several Ln's. Although the monitor may be capable of measuring and calculating much more complex and sophisticated parameters, it may by that most of these are not needed by the user to comply with the original requirements of the system.

Also, if data from the noise monitor is to be downloaded remotely without physical access to the equipment, the number of measurements and the amount of other data stored must be considered when specifying the type of connection from the PC to the monitor.

The needs of acoustic professionals and system operators may often be quite diverse and great care should be taken to ensure that a noise monitoring system does not become overly complex simply due to the specification of unnecessary measurements. A large proportion of the price of a noise monitoring system is the hardware, and the specification of unnecessary measurements can dramatically increase the cost.

- What measurements the system can provide
- What data is required for the routine operation of the system?
- Who is specifying the system and why
- How much data is needed for compliance with regulations and guidelines

Although to many users, the noise monitors themselves are simply boxes at the end of a telephone line, without this hardware the measurement of the noise itself would not be possible.

Therefore it is essential that the noise monitoring equipment is carefully specified, and serious consideration given to the location of the equipment, not just the acoustic parameters that are required. Choosing the wrong location, both in acoustic and physical terms, can result in many problems that can seriously reduce the effectiveness of the system and increase both the initial and on going costs.

LOCATING THE MONITOR

It is common to find that a noise monitoring has been specified by a consultant, purchased by a contractor or property management company and operated by the end user. One of the most common problems with this type of arrangement is that often no one person or company is responsible for the entire operation and maintenance of the system.

Common problems that occur include:

- No access to equipment for servicing (where are the keys?)
- Disconnection of the telephone, GSM or power when the bill is not paid
- Change of ownership of the property on which the equipment is located

Some of the responsibility must fall upon the supplier to ensure that all parties involved are aware of the appropriate contacts at each location, but it is often the case that after the equipment is delivered and installed, particularly where the system is permanent, that staff change or the ownership of the property changes, resulting in some confusion as to who is responsible.

There have been instances where the new owners of a house have no idea that their house is the central monitoring location for a noise monitoring system, and that disconnecting the power the garage during building work has caused problems at the host PC resulting in many telephone calls between the user, the supplier and the local authority when monthly reports do not appear.

Where the location of the equipment is on public buildings or property, control over the access to the equipment can usually be resolved, but where the location of the monitors is on private land or buildings, there are many issues such as on going access.

Choosing a location for a noise monitor should not be made solely on the grounds of good "acoustics" but should also involve a consideration of the practicalities of both the installation and maintenance of the system. Preparation and communication between all parties involved is essential to ensure that the often-significant amounts of money spent on a system are not increased due to a lack of thought.

Where a maintenance contract is in place, access to the equipment may be required at short notice. If gaining access to the equipment involves numerous telephone calls to different parties who have responsibility for the land, power, telephone lines or any other services, the time taken to return the equipment to operation may be significantly increased.

Whilst it is the responsibility of the supplier to ensure that the equipment is safe and does not present any hazards to the surrounding population, maintaining the environment in which the equipment is located is often overlooked and can cause safety concerns to both the local population and the supplier.

If weather measurement is to be part of the noise monitoring system, the local weather conditions must be considered. The location of weather sensors, particularly those for wind speed and wind direction, can have a huge effect upon the quality of the data from the sensors. Wind swirling around a building can produce a wind direction plot that looks like a uniform distribution as the vane spins through 360 degrees!

The self-induced wind noise from the noise monitor should also be considered if the prevailing weather conditions show that the wind speeds around the noise monitor can regularly exceed 5m/s

If the local weather conditions produce wind speeds of 30km/h (8 m/s) a typical outdoor microphone system may produce noise levels of 45dB(A), increasing the background levels by a significant amount.

GOOD COMMUNICATION

The widespread availability of mobile telephones has provided the technology to allow data to be downloaded remotely from noise monitors. This attractive option has several obvious advantages, the main being the removable of the need to install a cable connection to the noise monitor. If the location of the monitor is remote from populated areas, the cost of installing a telephone line can be prohibitive.

However, in the urban environment, where most properties have a fixed connection to a telephone network, the options available for communication with the noise monitor are wider.

- Direct RS232 Connection
- Fixed Telephone Line (PSTN or ISDN)
- GSM Modem

Until the advent of GPRS or 3G technologies, the GSM telephone network limits the speed of data download to a baud rate of 9600. Whilst this may be acceptable for small amounts of information, many noise monitors are storing more and more acoustic parameters, audio data and weather information resulting in increasing download times.

The nature of the GSM telephone system introduces the possibility that the data connection can be either dropped or disconnected when the "cell" or "hub" to which the system is connected becomes full. The local cell or hub has a limited number of connections, and some of these connections are reserved for emergency voice calls. Data connections are usually given a low priority and therefore are the first to be bounced or disconnected when the system reaches its maximum capacity. Also, if a cell is taken off line or fails, a mobile handset will automatically connect to the next cell as the user moves to the next area. A fixed GSM system will have to wait until the local cell is re-enabled or the fault fixed.

Care should also be taken when specifying the use of a GSM connection to ensure that the user is aware of the potential problems that may arise, and that this type of connection is not the ultimate solution. Although the initial cost of a fixed communications line can be higher, long term reliability and guarantee of access should be high on the list of priorities.

Where the "Sound Level Meter in a Box" may be powered by an internal or an external battery pack, for permanent installations, mains power is the only option to ensure that the noise measurements are made continuously. A backup battery is also essential to allow the noise monitor to continue operating and to store any measurements until the power is restored or the data can be downloaded.

Efficient solar power systems are now available for moderate cost, and these can often be used to power a noise monitor in conjunction with a rechargeable battery. However, as the weather conditions in the UK are often variable, the size of panel required to power a noise monitor could be significant, producing problems of both mounting and protection from deliberate damage.

Using a GSM Modem will also increase the power required to operate a noise monitor, again increasing the size of solar panel required to guarantee sufficient current to change the battery pack.

VANDALISM

It is not clear what part of a noise monitor is valuable to the world outside of noise measurement, but vandalism of permanent noise monitoring systems is not unknown. Fortunately the majority of noise monitors are able to withstand casual interest and use of warning labels and signs will often be a sufficient deterrent.

Where the noise monitor is to be located in an urban environment, it is often essential to reduce the visible profile of the monitor to an absolute minimum to ensure that it does not attract unwanted attention.

Noise Monitors designed for use at airports have usually been designed to withstand extremes of temperature and weather with little consideration given to the physical size of the package.

A new design of noise monitor is available where the profile of the equipment has been made as low as possible, using an industry standard "lamp post" to house the entire measurement chain. This noise monitor has been accepted for use in environments where planning consent would have been required for a traditional design of noise monitor.

SUMMARY

To provide an effective noise monitoring system that is to be used in an urban environment, careful consideration should be given to wide range of points, and not limited to the acoustic parameters that are available from the current range of noise monitors.

A quick checklist will allow the main points to be considered before a system is specified.

- Application
  - Why is the noise monitoring system needed?
  - What is the required end result?
- Measurements
  - What is required to comply with any regulations and guidelines?
  - What additional functions are required?
  - How long with the measurements take to download?
- Location
  - Is the location acoustically acceptable?
  - Is power and communications available?
  - Will the local weather conditions affect the noise measurements?
  - Is the location liable to vandalism or damage?
  - Can access be obtained for servicing and calibration?
- The Noise Monitor
  - Does the noise monitor meet the requirements above?