

SERVICES FOR CONSTRUCTION SITE NOISE AND VIBRATION MANAGEMENT

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1 INTRODUCTION

The construction of infrastructure and new buildings risks causing significant impact on the neighbourhood, particularly for major infrastructure projects. Due to local community concerns, construction activities are often subject to operational restrictions. To effectively operate within these restrictions, instrumentation is often deployed to monitor noise and / or vibration. An alternative approach to the purchasing and operating costly equipment to monitor compliance is available through Managed Services offering:

- Technology innovation enabling simultaneous noise and vibration monitoring
- manpower and cost reductions in monitoring resulting in a more economically attractive approach to traditional noise monitoring

An example of a construction project that resulted in problems due to noise and vibration impact is the West Toronto Diamond Project in Canada. This large construction project will construct an underpass to separate commuter rail lines and freight trains to the west of Toronto in Canada^{1,2}. Located centrally within the community, the project initially failed to address community concerns over noise from piling activities. After statutory investigation by the transport regulator, the regulatory authorities stipulated specific piling technology that could be used in the future, imposing operational limits and reporting requirements that significantly increased costs and extended the project by three years. If an active monitoring programme and a Web-based community engagement programme had been established prior to construction, complaints and the subsequent lengthy delays and cost overruns may have been avoided.

2 BACKGROUND

There are a range of technological changes and advances in recent years that have changed the way that one can monitor compliance of noise regulations and limits around a construction site to ensure enforcement of noise and vibration limit compliance³. As described in earlier papers by the authors^{3,4}, communication and computer developments have increased the amount of different types of useful data that can be transmitted and stored. This presents enormous potential for analysis and reuse, promising increased efficiency.

Advances include:

- From simply noise monitoring to noise management
- System architecture of modern noise management systems
- Noise management and professional databases
- Important design factors in noise monitoring terminals
- GPS technology
- Modern communication technologies
- GIS and aerial photography

In addition, recent developments have enabled the integration of noise and vibration monitoring into one system⁵.

These advances and some of the major challenges faced when designing, deploying and operating a system to monitor compliance of noise and vibration regulations and limits around a construction site have been described in previous papers by the authors⁶ where an alternative approach to facing these challenges through the use of noise monitoring services has also been described and compared to the use of traditional noise monitoring systems. Recently, the concept has been extended to simultaneously monitoring noise and vibration in the light of response from the construction community, resulting in a novel and innovative technique for integrating vibration monitoring and noise monitoring and management. This offers an economically sound approach to resolving good practice, highly suitable for the austerity decade.

3 NEW APPROACH TO MONITORING

Technology has also changed the way in which monitoring is established and accessed. Traditionally, customers acquire measurement equipment and a license for software and, after commissioning a supplier to implement the system, the customer then takes over all operational tasks relating to the system and its operation. In the last decade, many business applications have become available as web-based subscription services, instantly accessible through standard web-browsers, with no need to burden internal IT resources with installation of yet another application. This trend towards Cloud-Based computing is well established and many monitoring clients now conduct the monitoring programs on this model. Cloud computing is a way to increase capacity or add capabilities on the fly without investing in new infrastructure, training new personnel, or licensing new software. Cloud computing encompasses any subscription-based or pay-per-use service that, in real time over the Internet.

Just as organizations will rent office space and acquire cars on a fully-maintained lease basis, many organizations prefer neither to burden their balance sheets with noise monitoring technology assets nor to add additional maintenance tasks to already-stretched internal staff. Noise Instrumentation is now routinely offered on an **Asset Managed** basis where a simple monthly fee guarantees access to operational facilities.

By combining the cloud-based and asset-managed approaches, organizations can engage suppliers not just to provide inputs, but to be responsible for outputs and outcomes. This Outcome-Based approach lowers the total-cost-of-ownership of the monitoring solution by leveraging the instrument suppliers centralized resource pool, establishes agreed service levels around the outcomes, and frees up customer resources to focus on stakeholder management and instead of operating a system.

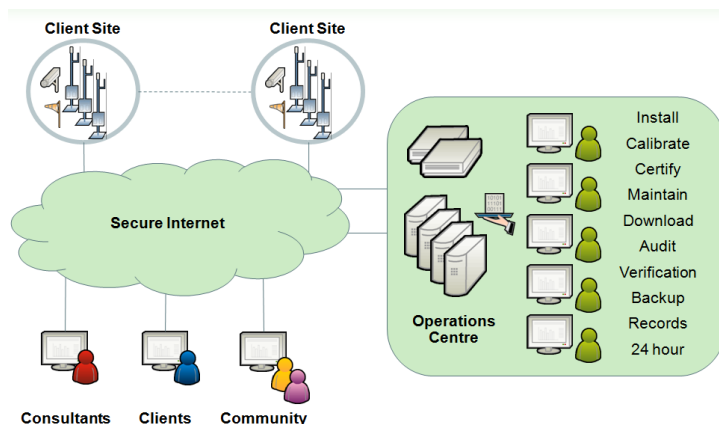


Figure 1 Cloud based computing delivers a wide range of benefits

4 THE RISE OF MONITORING SERVICES

The underlying need of construction contractors and their acoustic consultants is to demonstrate compliance with noise limits, not to operate a noise monitoring system. Noise Monitoring Services provide an alternative to struggling with setup, communication, data acquisition and system maintenance, all of which require skills which are not core to construction contractors nor their acoustic consultants. In order to better exploit the potentials offered by new technology, people are looking towards noise monitoring services and suppliers of these services are appearing⁷.

Service providers contract based on outcomes such as providing regular reports rather than only supplying equipment in which one must then invest resources to operate. Web based services can provide everything that is needed to show you are meeting ongoing noise obligations and has some benefits over the established approach of purchasing and operating a noise monitoring system:

Ensuring data quality – the site operating licence may be under threat, it is important that compliance monitoring is performed correctly.

Simplifying operations by contracting outcomes rather than purchasing technology

Optimising costs. Services from a specialist service provider may have a financial advantage in that the capital expenditure required to commence monitoring can be reduced as cost is spread out over the length of the contract rather than there being a large initial purchase of technology. A service provider, who is providing services to a number of clients, has the advantages of scale that a contractor on an individual construction site will never have which can reduce cost for the contractor.

Most importantly, outsourcing compliance monitoring to a specialist service provider enables the contractor to focus on construction and the consultant to focus on mitigation.

5 INTEGRATING VIBRATION AND NOISE MONITORING

Vibration from large construction projects can present a significant risk of damage to nearby property. Along with noise, vibration also has the potential to cause nuisance in the community, triggering complaints. If not managed properly then both can cause delay, increased project cost and potential litigation.

Project risk can be reduced by continuously monitoring noise and vibration. If done in real-time as described above, a professional solution can:

- automatically alert the user and his client anywhere with all the information needed to investigate an exceedance so that someone can take immediate action
- Automatically record noise and vibration data so that they can demonstrate compliance at all times
- Show communities and regulators that the project is taking its impact seriously and that it is being controlled
- Easily make detailed measurements available should the project need to respond to queries and complaints

Properly managing noise and vibration is key to reducing project risk, and with proactive monitoring one can reduce it by maintaining compliance and keeping communities and regulators happy.

Traditionally, vibration monitoring has usually been done using dedicated vibration monitoring units connected to dedicated vibration monitoring system software. However, the basic tasks and challenges of vibration monitoring system software are the same as for noise monitoring system

software. The major difference is that the parameters measured are different. Thus, by enabling interface with the vibration monitoring terminals and the storage and processing of vibration data, a professional noise monitoring system software can easily integrate vibration monitoring. Thus, noise and vibration monitoring can be integrated in one system. For construction sites, this provides the user with a better holistic approach and overview of the situation.

Often the noise needs to be monitored at the facades of noise sensitive locations whereas ground vibration needs to be monitored on the ground or in the basement of a building. Thus, sometimes, the terminal needs only monitor noise levels, sometimes only vibration levels while in other cases, monitoring of both is required. Therefore, the noise and vibration terminals need to be modular in order to control both the initial costs and the costs of equipment maintenance.

Commercial solutions based on this principle now exist. Such a solution, Construction Sentinel⁴ provides continuous monitoring of noise and/or vibration specifically for large construction projects and fulfils the demands to a professional solution outlined above.

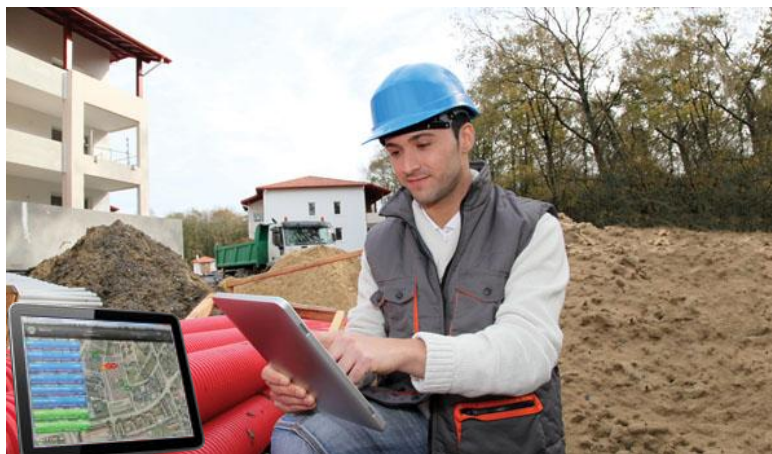


Figure 2 Today, monitoring systems are no longer limited to the office and can be used on site

6 CONCLUSIONS

The construction of infrastructure and new buildings causes changes to the environment of the neighbourhood which are often significant. They result in concern among local population and government and often result in restrictions to the noise and vibration produced by the project. To be effective and thus meet the demands on these restrictions, adequate enforcement is needed. Enforcement of noise and vibration limit compliance around construction sites needs to efficiently determine noise and vibration limit compliance, avoiding false positive exceedences, in order to provide a correct and true picture of the impact of the construction work.

There are a range of technological changes and advances in recent years that have changed the way that one can monitor compliance of noise regulations and limits around a construction site to ensure enforcement of noise limit compliance. These advances in technology solve some of the major challenges faced when deploying and operating a system to monitor compliance of noise regulations and limits around a construction site.

In tough economic times every business needs to control its cost and focus on its core business. Outsourcing noise and vibration monitoring to a specialist service provider helps to manage costs whilst providing a high quality result that delivers confidence to stakeholders; ultimately ensuring that construction projects can progress without the risk of delays caused by noise and vibration nuisance.

7 REFERENCES

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