THE POTENTIAL OF REAL-TIME NOISE MONITORING

Henk de Haan*[1] and Virgini Senden†[2]
dBA Noise Consultants Ltd, RR1 Site 14 Box 55, Okotoks, AB (403) 836 8806

1 Introduction

NoiseNet is the Canadian representative of Sensornet.nl. For over a decade, we have provided real-time web access to unmanned noise- and vibration monitors (including audio recordings) around airports, along railroads, highways and around industry. We helped clients make sense of Big Data by automatically analyzing data, developing source recognition and by providing customized reports. Real-time access to noise monitoring data results in increased confidence from the public, and drastically reduces response time and cost when dealing with complaints. Initially, these possibilities have been used to improve upon traditional noise monitoring, with identical goals for that kind of program. Recently however, unmanned noise measurements along light rail systems have been applied to assist in planned maintenance (rail re-surfacing, rolling stock maintenance) thus reducing maintenance cost.

2 Method

2.1 Traditional Monitoring

In traditional monitoring, data gathering, data analysis and reporting are separated in time. Disadvantages of this approach are the often fixed and limited duration of the monitoring, the impossibility to assess (the quality of) data while monitoring, the time-lapse between data acquisition and availability of analysis. Sometimes there's public distrust about the whole process. Which consultant has not been confronted with a remark along the lines of "It's not noisy now, you should have been here yesterday!"

2.2 Real-Time Monitoring

Real-Time Noise Monitoring (RTNM) allows access to gathered data (e.g. noise and vibration data, audio recordings, meteorological data, rail car speed) in real time by means of a dedicated website, with automated data analysis and reporting possibilities. This allows to evaluate and adjust the measurement program or the analysis while the program is active. Making certain webpages accessible to the public will build public confidence and is invaluable for complaint resolution.

A real-time monitoring solution consists of one or more sensors (e.g. a microphone and data acquisition devices (e.g. an SLM or RTA), a connection to the internet, a server with a database to gather and store the collected data, analysis software to extract information from the data, reporting tools and an interface to the client – a webpage.

* henk@dbanoise.com
† virgini@dbanoise.com

Custom solutions have been developed, e.g. for air force bases, where source recognition techniques were developed to distinguish between several types of helicopters (Chinook, Apache) and between helicopters and other sources (e.g. car passage). Other solutions were provided for construction projects in close proximity to 3rd party stakeholders, for communities exposed to high levels of multiple noise sources (road, rail and air traffic, shipping), around wind farms, race circuits and along rail lines.

3 Asset management using noise data

3.1 Rail Road Noise

RTNM projects typically start as compliance verification projects or in response to (potential) complaints, much the same as in traditional (noise) monitoring projects. Call it a better mousetrap. Recently, RTNM projects also proved useful for asset management purposes.

An important component of rail road noise has its root cause in the contact between wheel and the rail track. The smoother the track and the rounder the wheel, the less vibrations will result from their interaction. However, wear and tear will increase surface roughness of the track, and will cause the wheel to become less than perfectly round. Track can be resurfaced by grinding the rail, and wheels can be trued on a lathe. Ideally, this is done only when needed to minimize wear and tear, schedule interruptions and cost.

3.2 Rotterdam - The Hague Metropolis

One of the regional Light Rail Systems (LRS) in the Rotterdam – The Hague metropolis in the Netherlands is the Randstad rail, connecting Rotterdam, The Hague and Zoetermeer, a satellite city of The Hague. The area is densely populated, with residences in close proximity to the high-use tracks; noise is a potential issue.

However, noise could also provide insight in the condition of tracks and railcars, thus assisting in deciding when and where maintenance is required. A program was therefore designed to collect noise and vibration levels, train speed, weather data and track data (temperature, moisture) in one second intervals at four different locations. Also, the identification of every passing railcar is collected. All this results in approximately 9 billion data points a year; far too many for any human to extract useful information from. Dedicated software was developed to extract information from this mountain of data. An advantage of the software is

that analysis and reporting can be adapted as a result of learnings extracted from the information. Refer toFigure 1, displaying the vibration and sound levels before and after resurfacing the rails.

Figure 1 Effects of Resurfacing on Sound and Vibration Levels

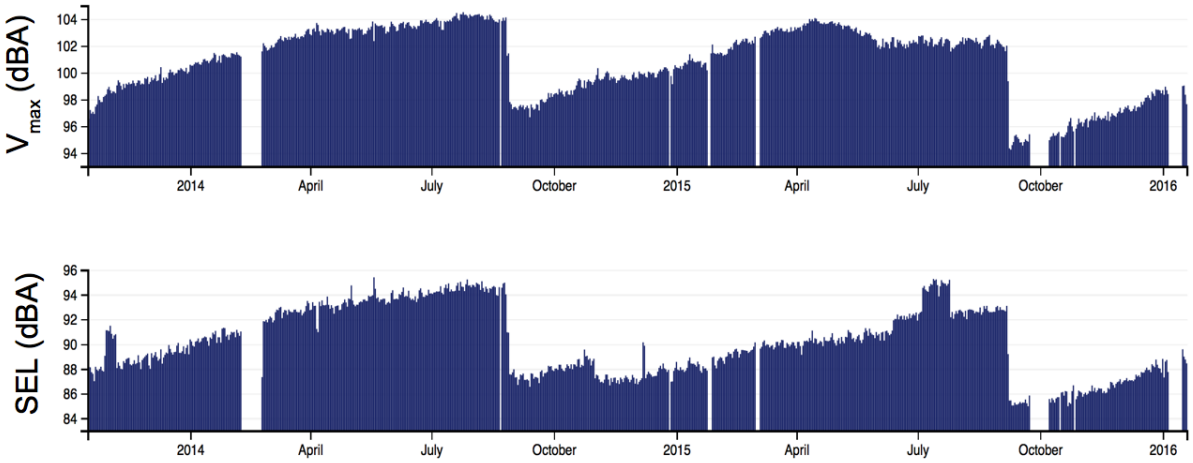

Figure 1 not only reveals the reduction in sound and vibration levels achieved as a result of resurfacing, but also provides a useful indication for when to resurface. This allows for planning the procedure to be conducted at the most optimal moment, considering both maintenance and schedule requirements.

Utilizing the available data, it is also possible to answer other questions that might arise, such as the average speed, the number of railcars per weekday or per hour, the average speed – the sky really is the limit. This offers quite a few possibilities for improvement. An example was combining location (GPS) data with railcar speed. A glance on a map displaying this information revealed that the trams frequently had to stop for traffic lights and were not enjoying the promised "green wave", allowing them to keep their schedule. The map was essential in moving the discussion forward; see Figure 2.

4 Conclusion

RTNM opens up fascinating new possibilities and opportunities by combining sensors, internet and Big Data analysis instruments. This include optimizing asset management, reducing maintenance cost and reducing the noise impact for residences in close proximity. It also increases public confidence in our work and provides a solid basis for discussions between stakeholders.

Remerciements/Acknowledgments

We want to than mr. Ron Maas from Sensornet.nl for allowing the use of their information.

Figure 2 Average Speed (km/hr)