On the right track for quieter rail infrastructure

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Credit: AI-generated image (disclaimer)

The EU QUIET-TRACK project offers a noise reduction and track monitoring system which is demonstrated to be a valuable and cost effective resource for rail infrastructure planning authorities.

As we go about our daily lives we are subject to a range of noise

pollution, especially in urban areas, which has been shown to have a detrimental impact on our health and wellbeing. The QUIET-TRACK project has set out to reduce some of this ambient noise by ensuring that noise from passenger trains is minimised and maintained at reasonable levels.

By instigating noise calculation procedures the project - guided by its vision for a quieter city - has provided noise mitigation systems which could be used by engineers to maintain or refurbish tracks. The QUIET-TRACK system looked more precisely at low frequency noise emission and the actual wheel-rail contact, and so offered more accurate measurements, predictions and locations of track decay for remedial attention. New solutions, which included embedded track systems, were developed to achieve noise reduction of at least 6 dB(A) in comparison to current global rolling noise amongst the network of participating infrastructure managers.

The advantages of in-service monitoring

The QUIET-TRACK project concentrated on track situations evidencing significant global 'pass-by noise'. The system monitored noise generated from the rail wheel interaction in trains travelling at moderate speeds (typically in the range 20-200 km/h). Sound pressure level measurements were taken from in-service trains by two microphones protected by boxes and attached to the wheel apparatus. Additionally, equipment included a GPS receiver, a high precision tachometer (measuring speed) mounted on the axle, a front-end unit and a computer for collating the data. Measurements were transmitted back to receiving units using the internet. The monitoring system could also be augmented with another microphone pair to monitor the track decay rate (TDR).

Key to the project was using in-service trains which meant that several track passages can be measured each week, providing highly precise data

on track roughness (a contributing factor to the rolling noise). Another noise contributor – wheel roughness – was inferred by working backwards through the calculations once the noise level had been determined. This was useful as it is impractical to gage wheel roughness whilst vehicles are in-service.

The data was then analysed to more effectively map noise levels as well as provide parameters for maximum roughness levels, which can then be used to assist maintenance efforts. For example, the system can locate areas of wheel and rail wear in track curves. This detection can then trigger a series of alarms for infrastructure managers pin-pointing areas of concern.

A planning toolkit for infrastructure authorities

One of the outputs from the QUIET-TRACK project was the creation of Noise-related Track-maintenance and Management Tool (NMT). The NMT included a noise mapping tool which detects noise-pollution hotspots and predicted the outcome of noise mitigation efforts. By combining this data with information about the number of people affected in given areas, authorities can make informed decisions about optimum interventions. To help with maintenance the NMT makes available a database of wheel and rail roughness, over time, for every section of the network. Overall increased monitoring accuracy results in more efficiency and cost savings as it reduces the implementation of additional catch-all noise mitigation interventions (such as noise barriers), track inspections as well as prolonging the lifetime of infrastructure.

The NMT offers a powerful tool for authorities, especially where non-track based solutions are unfeasible, as it makes cost-benefit calculations looking at the maximum noise reduction achievable against available budget and within the maintenance operational time-frame, thus

indicating the economic viable of potential solutions. This will prove valuable when it comes to producing noise reduction actions plans as requested by the EU's Environmental Noise Directive (END) and especially given that the solutions are applicable across the European Union not only to conventional rail tracks but also to tram, light rail transit (LRT) and metro.

More information: Project website: www.quiet-track.eu/

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