Data & Monitoring

Sensonic

Keeping an Intelligent Ear on Rail Infrastructure

By Daniel Pyke, CEng FIMMM

Humans are great at interpreting the world around us through our five senses.

We use two of these to sense the vibrating world around us through sound and touch. From a squeaking door hinge indicating it needs oil, to the rumble of thunder telling us to seek shelter, we instinctively interpret noise and vibrations to help us navigate the world.

Interpreting vibrations permeates our everyday lives, so it is no surprise it has also entered our everyday language too. E.g., "That doesn't sound right" may be heard when your car or kitchen appliances start making unusual noises which is then often followed by repair or replacement.

Why Don't We Listen to Railways?

Part of the challenge is the railway is long and the range of hearing via the human ear or microphones is limited, meaning historically we were largely deaf to this important data source.

However, Sensonic technology extends our range of vibration detection by using a fibreoptic cable and turning it into a myriad of vibration sensors along its length. Each kilometre of fibre cable is turned into over 150 sensitive vibration sensors.

Known as distributed acoustic sensing (DAS) the technology is already well established securing international borders and monitoring pipelines and powerlines and is now being brought to the railways by Sensonic to deliver improved rail infrastructure insights.

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Listening vs Understanding

Whilst gathering huge quantities of vibration data from along the whole length of a railway is now possible, to make it useful we must also apply intelligent data analysis. Sensonic uses the latest machine learning, artificial intelligence and advanced algorithms to generate actionable insights for railways spanning multiple disciplines.

What Can Vibration Reveal about the Railway?

Security

Sensitive enough to detect the vibrations from human footsteps, the technique and algorithms can be used for detecting trespass, digging and cable tampering. As fibreoptic cables are typically laid underground or in ducts/troughs, the covert and comprehensive coverage

delivers reliable security information across whole rail routes. This can be particularly important in remote and difficult-to-access areas, where traditional security measures may be impractical or ineffective.

Security alerts generated in real-time, are displayed to operations teams, delivering the alert type together with location information so they can initiate an appropriate response. Security intrusion data is also available historically for analysis to allow improved security planning and to assess the effectiveness of preventative security measures implemented, e.g. fences, patrols, CCTV etc.

Landslide/Rockfall

A potentially life-saving application is in landslide and rockfall detection. These natural hazards are an increasing challenge as extreme weather events become more common.

When a train encounters a large rockfall or landslide, it rarely ends well. By monitoring for characteristic ground movements and vibrations along railway routes, Sensonic allows railways to identify and respond to landslides before a natural hazard turns into a railway accident.

In the event of a landslide or rockfall, the Sensonic system generates an alert displayed to the railway operations teams together with a precise location. This enables them to act, avoiding loss of life and damage to both infrastructure and rolling stock.

Ease of Implementation

Fibreoptic cables are robust, have a long life, do not generate EMC issues and are already in common use in railway signalling and telecoms. One single fibre in a cable is all that is required to gather vibration data along its length, so often no new wayside equipment is needed.

Each Sensonic sensing unit can turn 100km of fibre, (~80km of track), into over 15,000 vibration sensors along the railway.

Together with connection to the fibre, a simple power and internet connection is all that is needed to start gathering data. This simplicity of roll-out gives both rapid installation and scalability to deliver insight and protect large lengths of track.
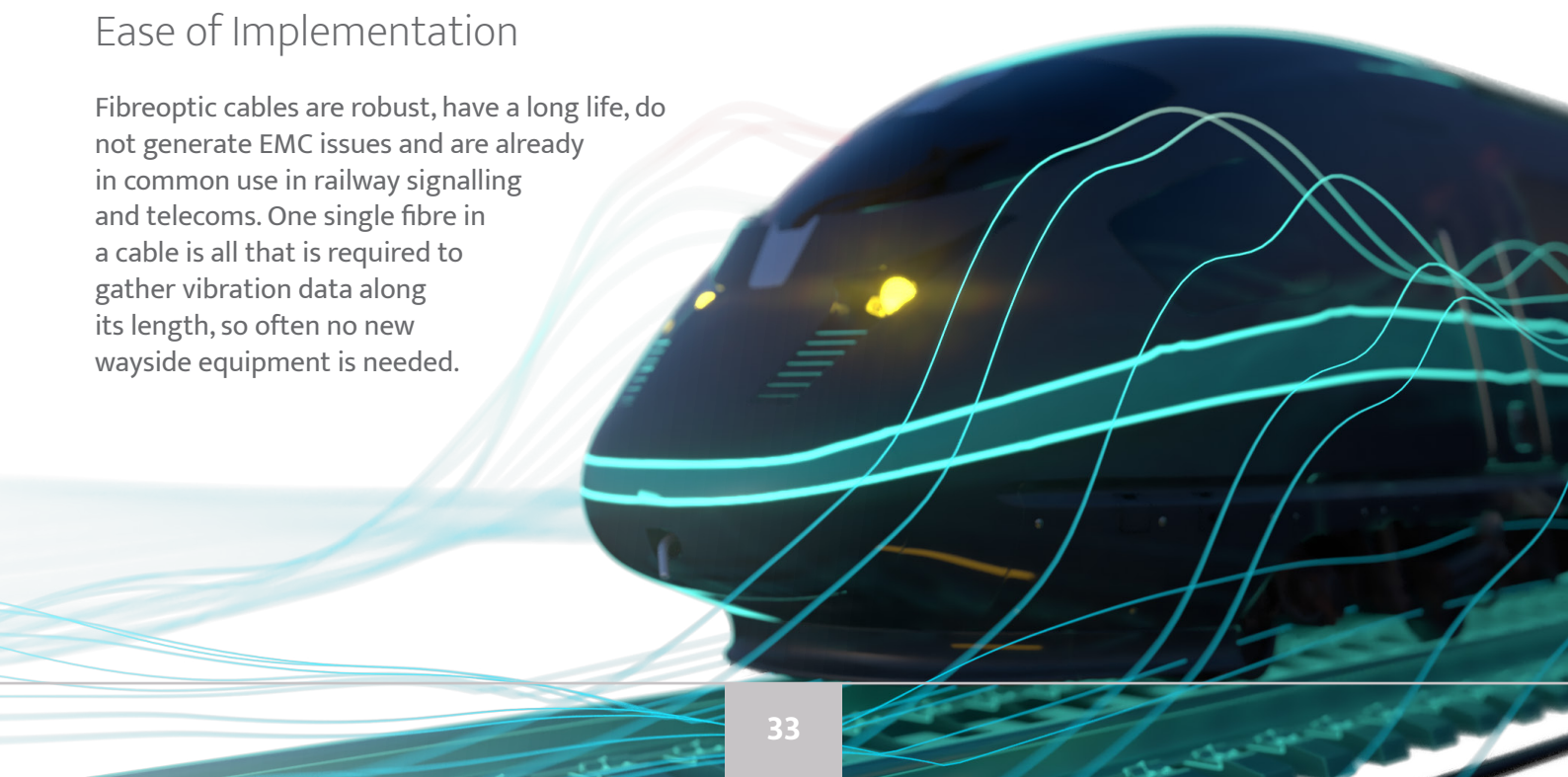
One Technology – Multiple Applications

Whilst I have discussed security, landslide and rockfall detection applications here, I am sure many wonder what else can be detected. The answer is many, and constantly growing, as the Sensonic R&D team explores a long list of use cases.

The applications available commercially today are:

- Security (trespass, digging and cable events)
- Landslide and rockfall
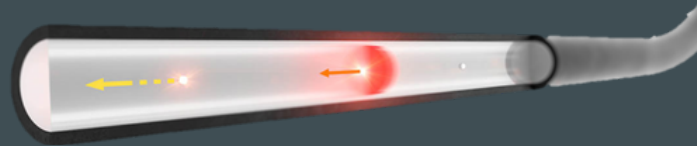- Track condition monitoring
- Catenary flashover location

Listen-out for new additions in the future and **contact** the Sensonic team for more information.

SENSONIC

ONE TECHNOLOGY MULTIPLE INSIGHTS

The versatility of fibre optic vibration sensing means many insights can be gained, with up to 80km being monitored by one Sensonic unit.

Security

We reveal security insights such as:
- Trespass
- Cable Events
- Digging

Landslide & Rockfall Alerting

24/7 detection of landslides and rockfalls:
- Keep staff safe
- Keep passengers safe
- Keep freight safe

Track Condition Monitoring

Empower maintainers to:
- Monitor changing track condition
- Identify and treat track issues early
- Assess the efficacy of maintenance interventions
- Deliver higher operational safety and availability

Flashover Location

Allow inspection and repair teams to respond more effectively to a fault allowing:
- Reduced inspection times
- Reduced likelihood damage is missed
- Improved repair times and system reliability

Get in touch...

Experience the power of the Sensonic Solution, through real-time insights and success stories. Book a demonstration today.

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