The future of rail: from digitalisation to decarbonisation

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The UK rail industry is in a period of rapid digital transformation. Whilst digital initiatives such as smart payments have already transformed the customer experience, digitisation and digital management of rail infrastructure are now accelerating operations and maintenance towards a more sustainable destination.

Already one of the cleanest forms of transport, the rail industry is continuing to play a leading role in helping to build a sustainable green economy by integrating smart technology solutions. In fact, the International Energy Agency (IEA) reported that urban and high-speed rail hold major promise to unlock substantial environmental benefits, including lower levels of carbon emissions, congestion and air pollution.

In the UK, Network Rail is taking major steps to kickstart a green revolution in the rail industry. Its ambitious carbon reduction plan, for instance, highlights technologies such as artificial intelligence and remote operations as playing a vital role in the future strategic decision-making needed to optimise networks for a greener, safer and more efficient future.

As a result, more large-scale accurate data and analysis on asset performance will be needed to support the widespread transformation of the rail industry in 2021 and into the future.

However, whilst real-time, data-driven decision-making is critical to the future of rail, it is important that any solution goes hand in hand with the industry’s aim to reduce its carbon footprint and decrease track exposure for workers. The Department for Transport has asked the rail industry to explore whether it would be possible to remove all diesel-only trains from the network by 2040 in England and Wales, and Transport Scotland has set an ambitious target of achieving this by 2035.

Geo-data models support the decarbonisation strategy

By leveraging technologies such as big data and the Internet of Things (IoT), the rail industry can make strides towards a long-term sustainable future. The past year has seen a surge in technology implementation across rail networks as pandemic restrictions have forced innovation. For example, with the help of the IoT, infrastructure has been increasingly monitored and inspected remotely, meaning engineers only need to go out onto the tracks for essential repairs. This method is not only safer and more efficient but also helps to drive down the environmental impact, as it requires far less travel.
In addition to harnessing the power of big data analytics, network operators are finding ways to turn data into valuable asset information so they can reuse and connect Geo-data models to support rail’s ongoing digital transformation and decarbonisation strategy. For example, in Scotland, point cloud data acquired for gauging surveys is being repurposed to support the design of new electrification schemes to phase out diesel trains. Accurate 3D Geo-data is also improving maintenance and services across the board, with fewer disruptions for passengers and processes becoming far more streamlined.

For example, the use of Geo-data is set to transform the cost-efficiency and long-term performance of vital track maintenance. A ‘first-of-a-kind’ innovation project currently being completed by Fugro has demonstrated how track alignments designed using Geo-data can be directly uploaded to the computer of a tamper machine to optimise tamping of railway lines. These data-rich models provide the basis for achieving a more sustainable whole-life geometry and increased track quality, which ultimately will reduce maintenance costs and improve safety. Data profiling can ensure smoother tracks across the network and is estimated to lower the need for traction power by around five per cent, offering clear carbon and financial savings to infrastructure and train operators.

**Sustainable data collection**
Alongside the opportunities afforded to the rail industry through big data capture, it is paramount to consider the way data is collected to ensure it becomes a long-term sustainable solution. Traditionally a labour-intensive task, track maintenance used to be assessed by teams of ground-based surveyors, which was time-intensive, costly to operators and ultimately impacted the environment due to the required travel to site.

Now, with remote operating systems, there is a clear alternative which offers a zero-carbon footprint. Using existing in-service passenger trains, ground-breaking specialised monitoring systems can be coupled to the train to survey the tracks with no disruptions to rail schedules and no additional fuel consumption. Utilising this kind of technology over a 100 km track corridor saves in the region of 1,200 hours conventional surveying time and results in a carbon emission reduction of approximately 50 per cent when compared to the number of van journeys needed to support a conventional survey, not to mention the savings in exposure hours for track workers.

What’s more, remote data acquisition over track sections of longer than 1 mile is faster than any other method and the resulting data is certified to Network Rail Survey Accuracy Band 1A. The speed of train-borne versus traditional ground surveys means that the network can be surveyed more regularly and cost-effectively, improving the productivity of rail maintenance and saving resources.

**Innovation equals evolution**
Continued innovation, whether through new technologies or new applications of existing technology, is vital to the successful implementation of long-term sustainable practices across the rail industry. By leveraging technology and real-time data insights efficiently, the industry has the opportunity to propel itself into a safer, greener and more efficient future. Rail operators and trusted partners must continue to work together on cutting-edge solutions and committing to innovating sustainable survey methods and technologies that support railway asset owners in their engineering, management and maintenance requirements for a safer and more liveable world.

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