



# Keeping track of long freight trains

As the rail sector increasingly embraces longer trains to drive efficiencies, advanced telematics are helping to ensure safety and reduce maintenance costs, opening up the prospect of intelligent and more sustainable rail freight transport.

*The Federal Railroad Administration has issued several reports this year examining the specific challenges of operating very long freight trains in the USA.*

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Imagine a freight train stretching for 2 km or more, a steel serpent winding its way through mountains, deserts and cities, carrying the lifeblood of global economies. This is not a scene from a futuristic movie but a reality unfolding in the heart of the rail freight sector.

From the vast plains of North America to the bustling industrial zones of Asia, and from the arid expanses of Australia to the diverse landscapes of Europe, long trains, and even very long trains are becoming the

new norm. And this is reshaping rail freight transport across continents.

The push towards the operation of longer trains is driven by several powerful forces. A seemingly insatiable demand for goods is projected to double the demand for the movement of freight by rail between now and 2030. Longer trains offer a way to meet this demand efficiently, moving more cargo with fewer locomotives and train crew. That translates into significant cost savings, improving rail's competitive edge over road haulage and other transport modes.

Technological advances have a crucial role to play. Distributed power and remote control of locomotives, along with improved couplers, have made the operation of longer trains more feasible. But that in turn requires infrastructure upgrades such as longer loops and

sidings, while improved signalling systems such as Positive Train Control are helping to ensure safer operations.

However, it's not just about efficiency and technology. Environmental considerations are increasingly important. Longer trains consume less energy and emit fewer pollutants per tonne of freight moved, making them a more sustainable option.

### Transformative benefits

For the rail industry, longer trains can be transformative in terms of optimising capacity. Each train can carry enough grain to feed an entire city or enough coal to power hundreds of homes, allowing additional volumes of freight to be carried without increasing the number of trains on the network significantly. This is one of the most compelling advantages.

Fuel efficiency is improved by making better use of the available tractive power, while reducing aerodynamic drag. Carrying the same volume of freight on fewer, longer trains can reduce congestion, especially on busy routes or in urban areas, while operating costs

are reduced because fewer crews and locomotives are deployed. The benefits are already being seen in a variety of industry sectors, ranging from mining, agriculture and energy to automotive and intermodal container transport.

North American Class I railroads such as Union Pacific, BNSF, CSX and Norfolk Southern have been among those leading the charge, moving to the operation of fewer and longer trains as part of the quiet revolution inspired by Precision Scheduled Railroading concepts. Mining companies such as BHP, Rio Tinto and Vale have for many years operated long and heavy trains on their standalone railways, while state-owned operators in China and India are among others adopting the same principles.

Based on a recent Association of American Railroads report, about 50% of freight trains in North America are now longer than 1.6 km (5 400 ft). Australia's mining sector routinely operates trains more than 2 km long, and the prevalence of long trains in China and India is also increasing rapidly. The share in Europe is much lower, but growing, with the EU specifying that all TEN-T corridors should be able to accommodate 750 m long trains, for example.

By 2034, the landscape is likely to look very different. Projections suggest that between 60% and 70% of freight trains globally could be classified as 'long' or 'very long'. In North America, up to 80% of freight trains could exceed 2 km in length, while there will also be significant increases in Asia and parts of Europe.

However, recent experience in North America has underlined that the operation of long trains brings specific challenges. Earlier this year, the Federal Railroad Administration produced three reports into the safety and performance of trains more than 2 286 m (7 500 ft) in length (RG 7.24 p17). The US Congress also commissioned a report from the National Academies of Sciences, Engineering & Medicine into the impact of long freight trains, which was released on September 17. The study

was asked to evaluate issues around the safety of long freight trains, risk management practices and railroad operations, crew workload and training, as well as potential conflicts with passenger services and the risks associated with long trains blocking level crossings for longer periods.

## The role of telematics

It is clear that telematics and real-time information on train dynamics are critical to the safe operation of longer trains. Weight distribution, compressive and tensile forces, braking, and communication all need careful management as the giant trains slink across the landscape. Unlike traditional wayside detectors, which only provide an intermittent snapshot, continuous condition monitoring can alert train crew to potential issues at any point along the train whenever they emerge.

With 15 years of specialised experience in the rail industry, coupled with more than 25 years of IoT expertise in the aviation, defence and logistics sectors, Trilogical Technologies is a prominent player in remote condition monitoring, diagnostics and asset management, monitoring thousands of mobile assets across the Middle East, Asia, and Africa.

The company is now pioneering telematics for long freight trains through its Long-Train Intelligence System. Our approach is built on the belief that a train is not just a collection of parts but a cohesive organism, and our vision is to transform the way railways monitor and manage these steel giants. LTIS is designed to take a holistic view, with seamless integration of all components to enhance both performance and safety.

The system brings together several key components, such as our Control FREAK locomotive diagnostics platform, which provides real-time data on performance and health, and the RailBlazer wagon telematics system offering precise GPS tracking, smart sensor analysis, and real-time health

updates. These are linked by a Mesh Communication technology to ensure continuous, reliable communication across the entire train length, including real-time End-of-Train alerts. A Locomotive Driver Advisory application provides the train crew with comprehensive and easy-to-interpret data on the train's status.

## Multiple benefits


An integrated telematics concept offers a range of benefits, addressing aspects such as safety, operational efficiency, maintenance and customer satisfaction.

In terms of safety, Continuous Train Integrity Monitoring oversees the train consist from end to end, ensuring the position of each vehicle and verifying train integrity. A Functionality & Health Monitoring app oversees the status and performance of key train components, enabling immediate corrective actions to be taken in the event that any anomalies are detected. And the driver advisory system offers real-time status updates, in-cab alerts, and recommended preventive actions, enhancing crew attentiveness.

Operational benefits extend to train marshalling yard and terminal management, where the precise GPS tracking of individual wagons can help to optimise yard management and vehicle allocation. There are also safety benefits in terms of enhanced situational awareness of brake status and critical impacts during coupling and loading processes.

Condition monitoring feeds into more efficient maintenance practices, with real-time health updates allowing timely interventions and reducing downtime. Shifting from scheduled to mileage-based maintenance can save about 30% in maintenance costs, while a proactive approach based on real-time health monitoring and intelligent sensor analysis can further extend service intervals and minimise disruption.

Meanwhile, intelligent data analysis can boost service quality and reliability, increasing customer satisfaction and generating new business as shipments are delivered more reliably and efficiently. Real-time tracking also contributes to supply chain transparency, keeping shippers informed and improving logistics planning.

It seems clear that the rail industry stands at the cusp of a new era, with longer trains powered by intelligent telematics offering a path to greater efficiency, improved safety and enhanced competitiveness, as well as direct financial benefits. Embracing these technologies is not just an option for operators looking to thrive in this new landscape, it is a necessity. 

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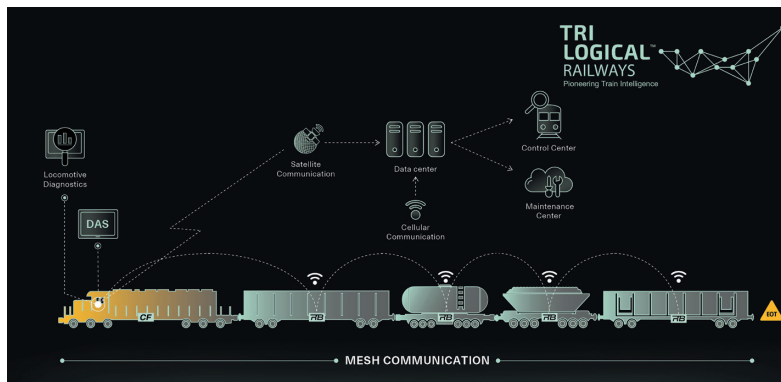


Fig 1. The architecture of Trilogical Technologies' Long-Train Intelligence System.